Ohio Agricultural Experiment Station.

BULLETIN 45.

WOOSTER, OHIO, DECEMBER, 1892.

INSECTS AFFECTING

THE

BLACKBERRY AND RASPBERRY.

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NORWALK, OHIO.
THE LANING PTG. CO., STATE PRINTERS.
1893.

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BULLETIN
OF THE
OHIO AGRICULTURAL EXPERIMENT STATION.

VOL. V, NO VIII
Whole Number 45 | SECOND SERIES | DECEMBER, 1892.

INSECTS AFFECTING THE BLACKBERRY AND RASPBERRY.

BY F. M. WEBSTER.

On observing an insect on or in any portion of his plants, the first question that presents itself to the fruit grower is, if the insects are few, will they increase and injure my crop? If the pests are already numerous he will ask himself, how much injury are they likely to work?

In the following list are included all species, known to the writer to affect these fruits, without reference to the amount of injury they are likely to inflict.

In the summary the list is divided by numbers into three divisions: First, such as are always more or less abundant and known to be especially destructive; second, such as are not ordinarily destructive, yet sometimes work serious injury, third, such as are not known as being seriously injurious. The fruit grower must prepare to fight the first, carefully watch the second, while the third will ordinarily require but little attention, unless very abundant, which is not usually the case. In the same manner he will be able to determine the remedy or preventive to be applied in each case, as all species are arranged by number under the measure known to be the most effective; thus, No. 4, will be found in first division, as it is becoming every year more abundant and destructive, and also following Hellebore, as that is the best insecticide to use against them. No. 57, will be found in the second division, as it is only occasionally injurious, and this number will appear again under Pruning, as that is the only effective measure at present known whereby we may fight them.

ACKNOWLEDGMENTS.

Figs. 1, 2, 14, 15, 16, 17, 21, 22, 23, were received from Prof. John B. Smith, of the New Jersey Experiment Station, Figs 5, 6, 7, 8, 9, from Prof. L. Bruner, of the Nebraska Station, Figs. 4, 12, 24, of Prof. James Fletcher, of the Central Experimental Farm, Canada, Figs 3, 11, 19, 20, 25, 26, 35, 37, of the U. S. Department of Agriculture, Figs 27, 28, of Prof M H. Beckwith, of the Delaware Station. Fig. 30 was drawn by Miss Freda Detmers.

1. The Blackberry Leaf Miner.

Fenusa rubi Forbes.

(Ord Hymenoptera Fam Tenthredinidæ)

This insect was described under the name ("*Metallus rubi*, gen. et sp. nov[1].") from two specimens, sex not given, bred from small white larvæ found mining in the leaves of blackberry. In Cresson's Synopsis of the Hymenoptera of North America, p. 160, the species is given as "*Fenusa rubi*, Forbes, (*Metallus*) (var. *curta*?") thus indicating the possibility of its being a variety of *F. curta*, Norton, described from females only.[2]

As the publication containing Norton's description is not easily accessible on account of rarity, even among entomologists, the original descriptions are here given:

F. curtus

Female black, abdomen piceous. Antennæ toward tip, the labrum and mandibles piceous; a smooth fovea between antennæ; tigulæ and abdomen piceous; thorax shining, smooth, each segment of abdomen depressed toward apex; legs ochraceous; coxæ and femora (except at the tip) black; apical joints of tarsi blackish; wings semi-transparent, stigma and costa darker, nervulus black. Length 0. 14. Ex wings 0. 32 each. Pa.

F. rubi.

Head, thorax, and abdomen shining black, clothed with short, yellowish pubescence; antennæ sparingly pubescent, strongly compressed, third joint about five and one-half times the length of the fourth, fourth and fifth equal, sixth, seventh and eighth successively a little shorter, the ninth longer than eighth; legs pale; all the femora and the posterior tibiæ fuscous; wings smoky, almost black, but slightly tinged with fulvous. Length 3.5 mm. Expanse 8.5 mm

The specimens, from which Prof. Forbes' description was drawn, were reared September 9th and 10th, from leaves in which larvæ were observed mining on August 12th in Central Illinois, and the larva was described from a single specimen taken from blackberry leaf. "Transformations occurred in the earth, the larvæ having deserted the leaves as early as September 6th."

I do not find, elsewhere, any reference to the habits of other species of this genus, in America. On anatomical grounds they are placed among the saw flies, family *Tenthredinidæ*. Norton states[3] that the species of *Fenusa* are the smallest included in this family.

2. *Blennocampa paupera* Prov.

(Ord Hymenoptera Fam Tenthredinidæ)

This was described from the female, from Canada[4], being first placed

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[1]14th Rep. State Ent Ill., p. 87, Pl. IX, Fig. 7, 1885
[2]Proc. Ent Soc Phila., 1, p. 199, 1861
[3]Trans. Am. Ent. Soc., 1, p. 225
[4]Faun Ent Can., II, 742

in the genus Selandria. I have not access to the original description by the Abbé Léon Provancher, and, therefore, cannot say whether or not he includes anything of the habits of the species with his description. I have myself observed the females ovipositing in the young leaf buds of the blackberry, in Indiana, in April, but failed to rear the larvæ. A closely allied species, *B. pygmæa*, say, is known to feed upon the grape.

The Dog Wood Saw Fly (?)

3. *Harpiphorus varianus* Nort. (?)

(Ord Hymenoptera Fam Tenthredinidæ.)

On October 10th, 1891, near Columbus, Ohio, I found a single larva of an unknown species of Saw Fly, on leaf of wild blackberry. Although it fed for a considerable time in confinement, and afterwards entered the earth, the adult never appeared.

On October 7th, 1892, near Wooster, Ohio, I again found specimens feeding upon the foliage of the blackberry in considerable abundance. A variation in the coloration of these, led from my Columbus specimen through various differences in the dark markings, almost to a typical larva of the Dog-wood affecting species. I could, however, find none on *Cornus*. A supply of these larvæ were collected, and in confinement fed freely on blackberry, and, on pieces of decayed wood being placed in the breeding cage, a number burrowed into them, precisely as the Dog-wood species has been observed to do. Once, by mistake, I gave them a sprig of red raspberry for food, and ere I became aware of the error three of my larvæ had perished. On substituting the blackberry again no more fatalities occurred. October 29th, a few larvæ were yet to be found in the woods. Some of the earlier collected larvæ were affected by an external parasite, which has not yet been reared.

Though the markings of the majority of my larvæ, as well as their habit of burrowing in decayed wood to transform, would indicate the Dog-wood species, yet I am not sure they are identical, nor am I quite sure that *H. varianus* is the true name of the Dog-wood Saw Fly. It may be *H. testaceus*.[5]

One of my larvæ on entering the wood was entirely black above the spiracle region, and another was black with the junctures of the segments light, giving to it a barred appearance, not unlike that of some of the larger Iulus. From the number of larvæ which have entered the wood, I hope to secure adults which will settle the question of species. definitely.

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[5] Insect Life, 2, p. 239.

The Raspberry Saw Fly.

4. *Selandria rubi* Harris.

(Ord. Hymernoptera: Fam Tenthredinidæ)

I find the earlier references to this insect exceedingly unsatisfactory. In a letter to Dr. Harris, from N. Darling, of New Haven, Conn., dated May 14, 1846, the following occurs:

"I have been fortunate enough to take, on the raspberry bushes, a plentiful "supply of the new insect *Selandria* (*Hoplocampa*) *rubi*; * * *. That you "may see the manner in which the eggs are deposited, I enclose in the quill (to pre- "vent wilting) a leaf with a number of eggs upon it, or rather in it. The eggs seem "to have been placed between the coats of the leaf, by the side of the ribs. * * *. "The larvæ are now beginning to come out on the leaves."[6]

Norton[7] refers to an address of Mr. Darling, bearing date of 1845, in which the species is also mentioned, leaving us to infer that the insect had been observed, about New Haven, in no great abundance prior to 1846, and had been, previous to this date, referred to Dr. Harris. Walsh and Riley state[8] that Harris described the species in the New England Farmer in 1850. It is also referred to by Norton in Proc. Boston Soc., 7, p. 235, and again, *loc. cit.*, 8, p. 221.

In the literature for the years 1850 to 1860, to which I have access, I find nothing whatever. In the Ohio Farmer, of June 16, 1860, Mr. J. Kirkpatrick mentions a larva which "eats longitudinal blotches out of the leaves of the raspberry and seems to be partly gregarious." In 1869 Messrs. Walsh and Riley mention its occurrence in great abundance in certain parts of Illinois, especially along the Illinois river in the vacinity of Lacon.[9] In 1874 Prof. W. Saunders published a short paper treating of raspberry insects, in which he gave about all the information in regard to the species that we at present possess. How much of this is original I have no way of knowing, but have decided to give it practically as it was published:

"The perfect insect, which is a four winged fly belonging to the order Hymenoptera, appears on the wing about the middle of May. We noticed them during the past summer first on the 10th; in the summer of 1872 they were not observed until the 21st; usually they may be found from about the middle of May until early in June. The wings, which are transparent with a shining surface and metallic hue, measure, when expanded, about half an inch across; the veins are black, and there is also a streak of black along the front margin extending more than half way towards the tip of the wing. The anterior part of the body is black, the abdomen dark reddish. In common with some other species of Selandria, these flies have a habit of falling to the ground when disturbed, especially in the cool of the morning, and remaing inactive long enough to enable one to catch them; but with the increasing heat of the day they are much more lively, and take wing readily when approached.

"The egg, as it appears when squeezed from the body of the female, is about one-thirtieth of an inch long and a little over one-hundreth of an inch wide at its widest portion. In form it approaches a long oval, rather obtuse at the ends, with

[6] Harris Correspondence, p. 260.

[7] Trans. Am. Ent. Soc., Vol. 1, p. 249.

[8] Am. Entomologist, 1, p. 224.

[9] Loc. cit.

its greatest diameter a little before the middle. Color white, with a faint yellow tinge and a smooth glossy surface, semi-transparent. The enveloping membrane is very thin and easily ruptured, discharging watery-looking contents. Only seven or eight eggs were obtained from the body of the female examined; possibly it might have previously deposited most of its stock. The eggs are buried beneath the skin of the leaf, close alongside of the ribs and veins, placed there by means of the saw-like apparatus with which the female is provided, where it swells somewhat and produces a slight discoloration of the cuticle on the upper surface. The skin covering the surface of the swelling is so thin and semi-transparent that the movements of the larva may be observed a day or two before hatching, by the black spots on the side of the head showing through. The larva escapes through an irregular hole made on one side of the swelling.

"The young larva as it appears when fresh from the egg: Length, when in motion, about one-twelfth of an inch; head large, semi-transparent, greenish white with a large black eye-like spot on each side, and with a number of short whitish hairs; mandibles pale brown.

"The body above is nearly white, semi-transparent, and thickly covered with transverse rows of white spines, nearly all of which are forked towards the tip; some of the spines on the anterior segments are more compound, having four or five branches; the tips of all the branches of the spines are blunt, nearly rounded. The under surface is similar to the upper in color and semi-transparency; feet and prolegs partake of the general color.

"After the first moult the head is medium sized as compared with the body, of a pale yellowish green, covered with short fleshy-looking hairs of the same color. The body above is of a uniform pale greenish-yellow color, excepting along the dorsal region, where, owing to the transparancy of the skin, the internal organs show though of a deeper shade of green. The surface of the body is thickly set with short greenish-yellow tubercles, most of which are forked at the tips, the two branches spreading in opposite directions, the greater portion of them extending anteriorly and posteriorly. Out of three specimens of this age examined, one varied from the others in having a pale brownish-yellow head. The under surface, feet and prolegs all pale greenish-yellow.

"With the subsequent moultings slight changes take place in the color of the head, first pale brownish or greenish-brown, then bluish-green, and sometimes the branches of the spines assume a brownish tint, especially on the anterior segments.

"When full grown this larva measures a little over half an inch; it is nearly cylindrical, tapering slightly towards the hinder segments.

"The head is rather small, nearly globular, pale green with a faint yellowish tinge, and a dark brown dot on each side, and a few very fine short hairs visible only with a strong magnifier. The mandibles are tipped with brown.

"The body above is dark green, thickly set with green tubercles, from which proceed fleshy-looking, forked, pale green, hair-like branches, most of them with their branches extending anteriorly and posteriorly. On the anterior part of the second segment there is a row of four spines with five branches each, most of the others are forked, but some few of them have three branches each. There are eight spines or tubercles on most of the segments, arranged more or less perfectly in a double transverse row. In some specimens the hair-like branches or appendages are black at the tips, and occasionally entirely black from the point of divergence.

"The under surface is similar to the upper; feet and prolegs green.

"When mature—from the middle to the latter end of June—these larvæ penetrate below the surface of the ground, where they construct little oval earthy cocoons, formed by glueing together particles of earth with silky and glutinous matter. These cocoons are toughly made, and may be taken out of the earth in which they are embedded, and even handled roughly without much danger of dislodging the larvæ. The specimens which we have bred, when examined a week or two after the cocoons were constructed, were still in the larval condition, although somewhat contracted in length. They all dried up and died before changing to pupæ, so we are as yet unable to indicate when this change takes place, the appearance of the chrysalis or its duration. As we have not met with more than one brood in the season, it is probable that the larvæ remain in the ground for some weeks unchanged, gradually transform to pupæ, and remain under ground in this condition until early the following spring.

"While in the larval state these insects may be readily destroyed by the use of hellebore."

The Raspberry Root-gall.

5. *Rhodites radicum* O S.

(Ord Hymenoptera Fam Cynipidæ)

This is the gall described by Harris in Insects Injurious to Vegetation, p. 549, as being made by *Cynips semipicea* Harr., but, according to Osten Sacken,[10] that insect was not the true cause of the gall, and Dr. Harris' species is probably a parasite of the true gall maker.

The gall is rounded, warty, sometimes very large, smooth, and occurs also on the roots of roses. It contains numerous cells with an intervening pithy matter. The true gall maker is described as follows:

Male, thirteen hundredths, and the female fifteen hundredths of an inch long. Coxæ of former black, of latter dark reddish, their bases black. "Head and antennæ black; two basal joints of the latter sometimes reddish-brown; mandibles reddish; thorax black, somewhat shining, densely but very finely and uniformly sculptured, so as to give its surface a silky appearance, parapsidal grooves broader and deeper than in the other species, running down to the humeri, intermediate grooves short, but well marked; pubescence of the thorax above scattered and hardly apparent, except on a side view, pleuræ with two smooth and shining oblong spaces; humeri very rugose, scutellum likewise, abdomen black, shining, sometimes brown; borders of segments sometimes paler; feet dark red, two hind pairs of femora infuscated, especially at base; tips of tarsi brown; wings: radial and apical areæ and a portion of the cubital clouded with brown; areolet rather small; its angle, directed towards the base of the wing, is for the most time pale, subobsolete; the portion of the cubital between the first transverse vein and the areolet is often subobsolete or obsolete in this species, the second transverse vein is smooth, without projection inside of the radial area, although sometimes slightly angular." [11]

The Seed-like Blackberry Gall.

6. *Diastrophus cuscutæformis* O. S.

(Ord Hymenoptera Fam Cynipidæ.)

This gall, like the preceding, affects the canes of blackberry, and may be easily known by their forming a cluster of small, round, hollow bodies around the stem. They are globular, seed-like and pressed closely together, having somewhat the appearance of the seeds of Cuscuta when found in winter. It was this resemblance which suggested the specific name. The galls are more or less spined, about one-tenth of an inch in diameter and of a reddish-brown color. The insect causing these galls is a small, four-winged, dark brown fly, with red feet and antennæ. The same remedial measure, collecting and burning the galls, is about all that can be done in the way of destruction or prevention. These galls, like the preceding, are also inhabited by guest flies and parasites

[10] Proc. Ent Soc Phila., 2, p 42.

[11] Loc. cit, p 46.

7. Cynipid Leaf Gall.

(Ord. Hymenoptera · Fam Cynipidæ)

On October 10, in the woods, near Columbus, Ohio, I found galls on leaves of blackberry which differed from any recorded as affecting this plant. They were situated on the leaf but not on the midrib, and extended both above and below, being covered with quite long robust though somewhat flexible appendages, which could hardly be called spines, though I know of no better term for them. These galls were not common, though in one instance two were found on one leaf. As the specimens are not now accessible, I have described them only from memory.

The Pithy Gall of the Blackberry.

8. *Diastrophus nebulosus* O. S.

(Ord. Hymenoptera Fam Cynipidæ)

This is an elongated, abrupt, pithy swelling on the twigs, from an inch to three inches in length and nearly an inch in diameter. The color is usually either a dark red, or a reddish brown, surface uneven, with irregular tubercles or deep longitudinal furrows, dividing the gall into four or five parallel ridges. The deformity is caused by the effect on the pith of the stings of small gall flies. These are black, with red feet and antennæ, and possessing four transparent wings. The insect passes the winter in the larval stage in the galls, and these last should be collected and burned during the winter, in order to prevent the inhabitants from escaping in the spring. I have usually observed them most abundant on the wild varieties. The pest is attacked by parasites, some of which closely resemble their hosts in form and color. Both the depredator and its parasite were described in 1863, from material found in the vicinity of Washington, D. C.[12]

According to Mr. Saunders[13] these galls are attacked by birds.

9. *Solenopsis fugax* Latr.

(Ord Hymenoptera Fam Formicidæ)

This diminutive ant is of a yellow color, quite abundant, and seemingly exceedingly variable in its food habits. According to Sir John Lubbock, it excavates its chambers and galleries in the walls of those of larger species, and harasses its unwilling hosts by making incursions into their nurseries and carrying off their young larvæ for food.[14] I have myself observed them infesting dead crickets; the fatty parts of cured hams; burrowing into ripe blackberries; in attendance upon a species of *Dactylopius* or root louse, on the roots of clover; and burrowing out and car-

[12] Proc. Ent. Soc. Phila., 2, p. 36.

[13] Ins. Inj. to Fruits, p 318.

[14] Ants, Bees and Wasps, Int. Sci., Series, p. 78.

rying away the substance of grains of seed corn, after the latter had been planted. It is also known to attack the ripe fruit of the strawberry.[15] Their attacks upon ripe fruit is exceedingly annoying, as their diminutive size prevents their being readily discovered. Several times this insect has made itself exceedingly disagreeable in my own house, by its presence in the pantry, and while in Washington some years since, the artist of the Division of Pomology, Department of Agriculture, complained to me of the trouble he experienced from a closely allied species, *S. debilis*, Mayr, eating the paints with which he was coloring the wax models of fruit.

The Upholster Bee.

10. *Ceratina dupla* Say.

(Ord Hymenoptera: Fam Apidæ.)

This little insect is not particularly injurious, but its presence in the canes, in such numbers as are usually found in a single stem, is apt to give rise to grave suspicions in the minds of those horticulturists who observe them, and it is only for the purpose of allaying such fears that the species is here described.

It is one of the wild bees, of a greenish color, and about one-fourth inch in length. In late spring, according to Packard and others, the female tunnels out the stems of blackberry and other pithy plants, often to the depth of six or seven inches, and only just large enough in diameter to admit her body, lining the walls with the finest of silken web. This tunnel she divides into chambers of about one-half inch in depth, which she fills with a mixture of pollen and honey, placing an egg in each. When finished, her tunnel is filled with a number of chambers each lined with silk, the ends being so drawn tightly across that they fit like drumheads, and being separated from each other by a partition of dirt. In about two months, if no accident has befallen them, or no parasite found their abode, they come forth as adults, having hatched from the egg and passed through the larval and pupal stages within their narrow cradle. The insect will select almost any pithy plant fitted for her purpose, and is not therefore likely to cause serious injury to any of them.*

The Comma Butterfly.**

11. *Grapta comma* Harr.

(Ord Lepidoptera Fam Nymphalidæ)

This is one of our common butterflies, and occurs in eastern, middle and northwestern states, North Carolina, Tennessee, Kansas to Texas.

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*I have also observed the female of *Stigmus fraternus*, Say, burrowing long, slender tortuous channels in the dead canes of raspberry, in September, in Northern Ohio.

**Determined from chrysalis by Prof. John B. Smith, New Brunswick, N. J.

[15] 13th Rept. State Ent. Ill., p. 113.

The food plants given by Prof. G. H. French[16] are hop, elm, nettle, false nettle and basswood.

A single larva was found by me in woods near Wooster, Ohio, Oct. 7th, feeding on foliage of blackberry. Transformed to chrysalis Oct. 9th. A few days later, another chrysalis was found attached to the leaf stem of blackberry.

The Raspberry Root Borer; The Blackberry Crown Borer.

12. *Bembecia marginata* Harris.

(Ord. Lepedoptera: Fam. Sesiidæ)

This species was described by Dr. Harris in 1839[17] as *Trochilium marginatum*, but he appears to have been at that time wholly unacquainted with its food plant.* In 1867, Mr. A. S. Fuller, of New York, sent to Mr. Walsh the larva of an Ægerian, probably this species, though the adult was not reared, which he found "boring in the stem of blackberry near the surface of the ground."[18] In 1869, Messrs. Walsh and Riley received a second larva, seemingly identical with that sent by Mr. Fuller. This was also found boring in the cane of blackberry near the surface of the ground, and seeming to give preference to the Dorchester variety. This time the pest came from Chas. Parry, Cinnaminson, N. J. In 1873, Dr. Riley, who had either received specimens from, or had observed it himself in various localities from Denver, Colorado, eastward to the Atlantic coast, described both adult and larva under the name *Ægeria rubi*,[19] by which it was for some time afterwards known. In this article Dr. Riley gives no personal observations of the behavior of the species in the field, he having reared adults from larvæ furnished by one of his correspondents. Quoting the observations of another of his correspondents, Maj. J. R. Muhleman, of Woodburn, Illinois, we are told that in 1870 moths were captured from July to September, sometimes resting on the leaves and at other times flying leisurely about the bushes. In the spring of 1872, the

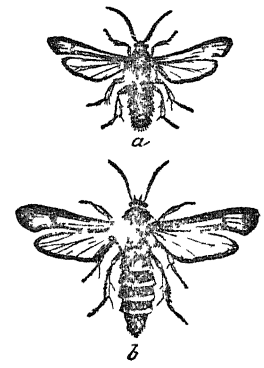

Fig. 1. *Bembecia marginata* Harris. *a*, male, *b*, female. After Harris

*Note.—Harris states that he captured *Ægeria caudata* on blackberry at Jackson, N. H., during a tour made between August 6 and 17, 1850, (Harr. Cor., p. 262) In his description of this species, as found in Morris Synopsis Lep., p. 139, he says the larva inhabits the stem of *Ribes floridum*, the native currant.

[16] Butterflies of E. United States, p. 185.

[17] Silliman's Am. Jour. Sci., Vol 36, p. 309.

[18] Pract. Ent., Vol. 2, p. 104, 1867.

[19] Sixth Rep. Ins. Mo., p. 113.

canes on examination showed that the young, after hatching from the egg, had entered the growing cane four to six inches above the ground and worked downward, so that the winter found it in the root. In spring, the half grown larva ascended through a different cane, larvæ of different sizes—a little over half to a full inch in length—being thus found at the height of four inches above the surface of the ground, with evidence of the exit of adult, in old canes, at the height of six inches, some having apparently been parasitized. In this case the insect seemed to prefer the Lawton to the Kittatinny.

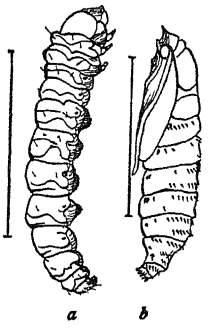

FIG. 2. Raspberry borer. *a*, larva, *b*, pupa. After Smith.

The larva, Fig. 2*a*, is described as pale yellow; head dark brown, mandibles black; cervical shield pale brown. Each segment of body with eight pale, shiny piliferous spots transversely arranged on 2, 3 and 12; the dorsal 4 quadrangularly arranged and the lateral 2 interrupted by stigmata on all the others. Thoracic legs slightly tinged with brown; prolegs with hooklets dark. Length 0.90–1.10 inch.

In a valuable contribution to a knowledge of this species, Dr. Geo. D Hulst[20] gives some personal observation relating to the habits of the adults, which were captured, in abundance, near Brooklyn, N. Y,, between August 26 and September 19, 1881.

"The moths, Fig 1, were observed to emerge from the pupæ during the early part of the day, and climbing up the plants near at hand, generally lie exposed to the sunshine on the upper surface of leaves The males begin to fly from 2 to 4 o'clock P. M., seeking the females which remain at rest The sexes pair during the night and with the early sunshine the female begins her flight for the purpose of laying her eggs. These are always, in my observation, laid on the standing blackberry, both wild and cultivated. In laying her eggs she alights on the upper surface of a blackberry leaf, old or young, high or low, indiscriminately—for a moment stands fluttering her wings and so stands on tiptoe—then moving sidewise and bending her abdomen around the edge of the leaf she deposits a single egg beneath, then flies on, as a rule only a yard or two, then lights again. They are very rarely seen at their work after 10 o'clock.

"The egg of the moth is perfectly oval in shape, and smooth under a high magnifying power. I kept eggs under ordinary conditions, but they had not hatched by midwinter. In the field none, so far as I could see, of many examined, were hatched when the leaves fell in late autumn. I was not able to find the larva or pupa (Fig. 2*b*.) and though I examined scores of blackberry canes both old and young, was not able to find one burrowed Last year (1882) in the same field I took only two specimens."

Farther on Dr. Hulst calls in question the habit of girdling and says: "it is certainly an anomaly, if not as well an impossibility among the lepidoptera." This assertion is altogether too rash and sweeping. Lepi-

[20]Bull. Brook. Ent. Soc., Vol. 6, p. 8, 1883.

dopterous larvæ can and do girdle the stems of the plants within which they burrow, and I think Prof. Smith has clearly shown that this is true of this species also. In the next sentence he (Hulse) goes on to say that "Harris says the eggs are laid singly on the stem near a leaf or small twig." I have not been able to find this statement of Harris, but have not access to his origininal paper in Silliman's Journal. This is exactly the language he uses in referring to *Oberia* (*Saperda*) *tripunctata*, and I fear Mr. Hulse has confused the two statements, as other writers have done also. It, however, seems to me that the two statements may not be unreconcilable. Insects act differently under different circumstances. Dr. Hulst's inability to find larvæ, of any size, in the locality where these observations took place, and but two of the adults the following year, is perplexing, but the obscurity will probably be cleared up as we learn more of the insect. Larvæ, varying greatly in size, were observed in spring both by Maj. Muhlman and Prof. Smith, and I this year (1892) under date of July 27, received from Mr. W. W. Farnsworth, Secretary State Horticultural Society, Waterville, Ohio, near Toledo, larvæ little more than half grown. The adult occurs in central Ohio in September, according to Dr. D. S. Kellicott[21]. In a more recent publication, Prof. John B. Smith[22], under the not altogether appropriate name of "Blackberry Crown Borer," after describing the adult, states that they appear in August and September, and also that "a single egg only is laid on the cane near the surface of the ground, or even a little below." As this does not fully agree with either Harris (?) or Hulst, we naturally look for some personal observations in substantiation, but the eggs, Prof. Smith tells us, were not observed by him, nor does he claim to have witnessed oviposition. Probably the statement was made on the ground that it was at this point that the larvæ, to all appearances, had entered the cane. He was, however, able to secure ample proof that the larvæ girdled the canes near the root, and also to substantiate our previous information in regard to the difference in the size of the larvæ in spring, thereby, to say the least, strongly implying a two-year period of development. This appears to me to be of the greatest economic importance, as, by closely watching his fields and destroying the depredator whenever dead or withering canes are observed, will serve to protect from future attack—the only remedy or preventive now known.

The adult insects are wasp-like in appearance, as indicated by the accompanying figures, of a black color banded with yellow. The wings are transparent.

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[21]Can. Ent., Vol. 24, p. 44.

[22]Bulletin N. N. J. Ag. Coll. Expt. Sta, Nov. 1891.

THE HEDGEHOG CATERPILLAR.

13. *Pyrrharctia isabella* Sm.-Abb.

(Crd. LEPIDOPTERA: Fam. ARCTIIDÆ.)

This is the well known "dark red at the middle and black at the extremities" colored caterpillar, which receives its common name "Hedgehog" from the habit of rolling itself into a ball when alarmed, with the thick mass of stiff hairs, with which the body is covered, pointing outward in all directions. The hairs on the first four and last two segments of the body are black, the rest are dark red. I have observed it in Ohio feeding on the tips of young shoots of the raspberry.

THE FALL WEB-WORM.

14. *Hyphantria cunea* Drury.

(Ord LEPIDOPTERA. Fam. ARCTIIDÆ.)

The following is from the fifth Report U. S. Entomological Commission.

"Passing the winter in the pupa state, the cocoons are found during the winter principally at the surface of the ground, mixed with dirt and rubbish, or in cracks and crevices of tree-boxes, in fences, and under door-steps and basement walls. The first moths issue from these cocoons in May, and laying their eggs in flat batches on the under side of the leaves. The young worms feeding preferably in company, webbing first one and then several leaves together, and gradually extending their sphere of action until a large part of the tree becomes involved. The worms becoming full grown in July, and spinning cocoons from which a second generation of moths issues early in August and lays eggs, from which worms hatch, so that they are once more in force by the latter part of August. The parent moth white with a varying number of spots; winged in both sexes; the female preferring to oviposit on box-elder (*Negundo aceroides*), the poplars, cottonwoods, ashes, and willows.

"The female moth deposits her eggs in a cluster on a leaf, sometimes upon the upper and sometimes on the lower side, usually near the end of a branch. Each cluster consists of a great many eggs, which are deposited close together and in regular rows, if the surface of the leaf permits it. In three instances those deposited by a single female were counted. The result was 394, 427, and 502, or on an average 441 eggs. But in addition to such large clusters, each female will deposit eggs in smaller and less regular patches, so that at least 500 eggs may be considered as the real number produced by a single individual. The egg, measuring 0.4 mm, is of a bright golden-yellow color, quite globular, and ornamented by numerous regular pits, which give it under a magnifying lens the appearance of a beautiful golden thimble. As the eggs approach the time of hatching this color disappears and gives place to a dull leaden hue.

"The interval between the time of depositing and hatching of the eggs for the first brood varies considerably, and the latter may be greatly retarded by inclement weather. Usually, however, not more than ten days are consumed in maturing the embryo within. The eggs of the summer brood seldom require more than one week to hatch.

"Without check the offspring of the one female moth might in a single season (assuming one-half of her progeny to be female and barring all checks) number 125,000 caterpillars in early fall—enough to ruin the shade trees of many a fine street.

"The caterpillars just born are pale yellow with two rows of black marks along the body, a black head, and with quite sparce hairs. When full grown they generally appear pale yellowish or greenish, with a broad dusky stripe along the sides, they are covered with whitish hairs, which spring from black and orange-yellow warts. The caterpillar is, however, very variable both as to depth of coloring and as to markings. Close observations have failed to show that different food produces changes in the coloration; in fact nearly all the various color varieties may be found upon the same tree. The fall generation is, however, on the whole, darker, with browner hairs than the spring generation.

"As soon as the young caterpillars hatch they immediately go to work to spin a small silken web for themselves, which by their united efforts soon grows large enough to be noticed upon the trees. Under this protecting shelter they feed in company, at first devouring only the green upper portions of the leaf and leaving the veins and lower skin unmolested. As they increase in size they enlarge their web by connecting it with the adjoining leaves and twigs; thus as they gradually work downwards their web becomes quite bulky, and, as it is filled with brown and skeletonized leaves and other discolored matter, as well as with their old skins, it becomes quite an unpleasant feature in our public thoroughfares and parks. The caterpillars always feed underneath these webs; but as soon as they approach maturity, which requires about one month, they commence to scatter about, searching for suitable places in which to spin their cocoons. If very numerous upon the same tree the food supply gives out, and they are forced by hunger to leave their sheltering homes before the usual time.

"When the young caterpillars are forced to leave their webs they do not drop suddenly to the ground, but suspend themselves by a fine silken thread, by means of which they easily recover the tree. Grown caterpillars, which measure 1.11 inches in length, do not spin such a thread. Both old and young ones drop themselves to the ground without spinning when disturbed or sorely pressed by hunger.

"Favorite recesses selected for pupation are the crevices in bark and similar shelters above ground; in some cases even the empty cocoons of other moths."*

The angles of tree-boxes, the rubbish collected around the base of trees and other like shelters are employed for this purpose, while the second brood prefer to bury themselves just under the surface of the ground, provided that the earth be soft enough for that purpose. The cocoon itself is thin and almost transparent, and is composed of a slight web of silk intermixed with a few hairs, or mixed with sand if made in the soil.

"The pupa is of a very dark-brown color, smooth and polished, and faintly punctate; it is characterized by a swelling or bulging about the middle. It is 0.60 inch long and 0.23 inch broad in the middle of its body, or where it bulges a little all round.

"The moths vary greatly, both in size and coloration. They have, in consequence of such variation, received many names, such as *cunea* Drury, *textor* Harr, *punctata* Fitch, *punctatissima* Smith. But there is no doubt, as proven from frequent breeding of specimens, that all of these names apply to the very same insect, or at most to slight varieties, and that Drury's name *cunea*, having priority, must be used for the species.

"The pupa state lasts from six to eight days for the summer brood, while the hibernating brood, however, requires as many months, according to the latitude in which they occur.

"In a general way it may be stated that conifers, grapes, and most herbaceous plants are free from their attacks, and it is very doubtful whether the species can mature upon them.

"The list of plants which follows is arranged according to the relative damage to the foliage in the city of Washington. The first named are most subject to attack, and, in fact, are almost always defoliated.

"Proportionate injury to different plants and shade trees.—The damage done in the city of Washington in 1886 was exceptional, but so was also the general damage throughout the New England states, if not throughout the country. In New England the greater predilection which the species showed for poplar, cottonwood,

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*We have known the substantial cocoon of Cerura to be used for this purpose. (C. V. R.)

and the ranker growing willows was everywhere manifest, and so much was this the case that the destruction of the first brood on these trees would have substantially lessened the damage to other trees.

"Plants marked 1 have lost from 75 to 100 per cent. of their foliage.
"Plants marked 2 have lost from 50 to 45 per cent. of their foliage.
"Plants marked 3 have lost from 25 to 50 per cent. of their foliage.
"Plants marked 4 have lost from 0 to 25 per cent. of their foliage.
"Plants marked with two figures have shown the relative immunity or injury indicated by both, the variation being in individual trees.

1. *Negundo aceroides*, Mœnch. (Box Elder.)
1. *Populus alba*, L. (European White Poplar.)
1. *Populus monilifera*, Aiton. (Cottonwood.)
1-2. *Populus balsamifera*, L. (Balsam Poplar.)
1-2. *Populus tremuloides*, Mich'x. (American Aspen.)
1-2. *Fraxinus americana*, L. (White Ash.)
1-2. *Fraxinus excelsior*, L. (European Ash.)
1-2. *Sambucus canadensis*, L. (Elder.)
1-2. *Pyrus*, species. (Cultivated Pear and Apple.)
1-2. *Prunus avium* and *cerasus*, L. (Cherries.)
1-4. *Syringa vulgaris*, L. (Lilac.)
1-4. *Ilex*, spec. (Holly.)
2. *Platanus occidentalis*, L. (Sycamore.)
2. *Salix*, species. (Willow.)
2. *Tilia americana*, L. (American Linden.)
2. *Tilia europæa*, L. (European Linden.)
2. *Populus dilatata*, Aiton. (Lombardy Poplar.)
2. *Ulmus americana*, L. (American White Elm.)
2-3. *Ulmus fulva*, Mich'x. (Slippery Elm.)
2-3. *Prunus armeniaca*. L. (Apricot.)
2-3. *Alnus maritima*, Muhl. (Alder.)
2-3. *Betula alba*, L. (White Birch.)
2-3. *Viburnum*, species. (Haw or Sloe.)
2-3. *Lonicera*, species. (Honeysuckles.)
2-3. *Prunus americana*, Marsh. (Wild Red Plum.)
2-3. *Celtis occidentalis*, L. (Hackberry.)
2-3. *Rosa*, species. (Rose.)
2-3. *Gossypium album*, Ham. (Cotton.)
2-3. *Cephalanthus occidentalis*, L. (Button Bush.)
2-4. *Convolvulus*, spec. (Morning Glory.)
2-4. *Acer saccharinum*, Wang. (Sugar Maple.)
2-4. *Geranium*, species. (Geranium.)
3. *Betula nigra*, L. (Red Birch.)
3. *Tecoma radicans*, Juss. (Trumpet Creeper.)
3. *Symphoricarpus racemosus*, Mich'x. (Snowberry.)
3. *Larix europæa*, Del. (European Larch.)
3. *Corylus americana*, Walt. (Hazelnut.)
3. *Quercus alba*, L. (White Oak.)
3. *Diospyros virginiana*, L. (Persimmon.)
3. *Carya*, species. (Hickory.)
3. *Juglans*, species. (Walnut.)
3. *Wistaria sinensis*, Del. (Chinese Wistaria.)
3. *Wistaria frutescens*, DC. (Native Wistaria.)
3. *Amelanchier canadensis*, T. & G. (Shad-bush.)

3. *Crataegus*, species. (Haw.)
3. *Rubus*, species. (Blackberry.)
3. *Spiraea*, species. (Spiraea)
3. *Ribes*, species. (Currant and Gooseberry.)
3. *Staphylea trifolia*, L. (Bladder Nut.)
3–4 *Cydonia vulgaris*, Pers. (Quince.)
3–4. *Asimina triloba*, Dun. (Pawpaw.)
3–4. *Berberis canadensis*, Pursh. (Barberry.)
3–4. *Catalpa bignonioides*, Walt. (Indian Bean.)
3–4. *Catalpa speciosa*, Ward. (Bignonia.)
3–4. *Euonymus atropurpureus*, Jaeg. (Burning Bush.)
3–4. *Cupressus thyoides*, L. (White Cedar.)
3–4. *Juniperus virginiana*, L. (Red Cedar.)
3–3. *Cornus florida*, L. (Flowering Dogwood.)
3–4. *Cornus alternifolia*, L. (Alternate-leaved Dogwood.)
3–4. *Carpinus americana*, Mich'x. (Hornbeam.)
3–4. *Castanea americana*, Mich'x. (American Chestnut.)
3–4. *Castanea pumila*, Mich'x. (Chinquapin.)
3–4. *Ostrya virginica*, Willd. (Hop Hornbeam.)
3–4. *Quersus coccinea*, Wang. (Scarlet Oak.)
3–4. *Quercus phellos*, L. (Willow Oak.)
3–4. *Quercus prinus*, L. (Chestnut Oak.)
3–4. *Quercus rubra*, L. (Red Oak.)
3–4. *Diospyros kaki*, L. (Japan Persimmon.)
3–4 *Buxus sempervirens*, L. (Common Box.)
3–4. *Hamamelis virginica*, L. (Witch Hazel.)
3–4. *Sassafras officinale*, Ness. (Sassafras.)
3–4. *Cercis canadensis*, L. (Red Bud.)
3–4. *Hibiscus syriacus*, L. (Tree Hibiscus.)
3–4. *Rhamnus alnifolius*, L'Her. (Alder-leaved Buckthorn.)
3–4. *Prunus virginiana*, L. (Choke-Cherry.)
3–4. *Persica vulgaris*, Mill. (Peach.)
3–4. *Æsculus hippocastanum*, L. (Horse Chestnut.)
3–4. *Paulownia imperialis*, Seeb. (Cigar Tree).
3–4. *Ailanthus glandulosus*, Daf. (Tree of Heaven.)
3–4. *Maclura aurantiaca*, Nutt. (Osage Orange.)
3–4. *Apelopsis quinquefolia.* (Virginia Creeper.)
3–4. *Clematis*, species. (Clematis.)
3–4. *Trifolium*, spec. (Clover.)
3–4. *Helianthus*, spec. (Sunflower.)
3–4 *Jasminum*, spec. (Jessamine.)
3–4. *Ficus carica*, L. (Fig.)
4. *Rhus cotinus*, L. (Smoke Tree.)
4. *Pinus*, spec. (Pine.)
4. *Taxus*, spec. (Yew.)
4. *Nysus multiflora*, Wang. (Sour Gum.)
4. *Fagus ferruginea*, Ait. (Beech.)
4. *Kalmia*, spec. (Laurel.)
4. *Rhododendron*, spec. (Rhododendron.)
4. *Ricinus communis*, L. (Castor-oil Plant.)
4. *Liquidambar styraciflua*, L. (Sweet Gum.)
4. *Gleditschia triacanthos*, L. (Honey Locust.)
4. *Gymnocladus canadensis*, Lamb. (Kentucky Coffee Tree.)
4. *Robina pseudacacia*, L. (Locust.)

4. *Liriodendron tulipifera*, L. (Tulip Tree.)
4. *Magnolia*, spec. (Magnolia.)
4. *Chionanthus virginicus*, L. (Fringe Tree.)
4. *Ligustrum vulgare*, L. (Privet.)
4. *Æsculus flava*, Ait. (Sweet Buckeye.)
4. *Æsculus glabra*, Willd. (Ohio Buckeye.)
4. *Morus rubra*, L. (Red Mulberry.)
4. *Zanthoxylum americanum*, M. (Prickly Ash.)
4. *Acer dasycarpum*, Ehrh. (White or Silver Maple.)
4. *Acer rubrum*, Wang. (Red Maple.)

"Trees in the vicinity of the white poplar and cottonwood suffered most. Even trees not usually injured, as, for instance, the sugar maple, are often badly defoliated when in such contiguity."

The Waved Lagoa.

15. *Lagoa crispata* Pack.

(Ord. Lepidoptera: Fam. Liparidæ.)

According to Dr. Packard[23], the caterpillar of this species was reared from the raspberry, yet it is not a common inhabitant of this plant, being more likely to be found on the plum or apple. The larva is a curious woolly caterpillar nearly oval, about three-fourths of an inch long, covered above with brownish evenly-shorn hairs, which are raised to a ridge along the middle of the back and sloped off on each side. With wings expanded the moth measures about one and three-fourths of an inch across; the color is straw-yellow or yellowish cream with the fore-wings more or less dusky. The caterpillar reaches maturity in September, spins a tough cocoon, from which the adult emerges the following July. Common south and west, rarer north.

The Saddle-back Caterpillar.

16. *Empretia stimulea* Clemens.

(Ord. Lepidoptera: Fam. limacodidæ.)

The odd form and grotesque colorations of this caterpillar render it a striking object and never fail to excite the wonder of those not versed in entomological affairs. It is of a reddish brown color, rounded above, flattened beneath, armed with prickly thorns, which are largest on the fourth and tenth segments; and with a bright pea-green patch, somewhat resembling a saddle in form, over the middle portion of the body, centered with a broad, elliptical, reddish spot, the red spot and green patch both being edged with white. The under part of the body is flesh colored. It has six legs, like other caterpillars, but no prolegs. If the thorns be applied to the back of the hand they cause an itching sensation like the sting of a nettle. With the wings

Fig. 3. *Empretia stimulea*. Adult. After Hubbard.

[23]Fifth Rep. U. S. E. Comm., p. 139.

spread, the adult spans nearly one and one-half inch; the wings are of a deep, rich, reddish velvety brown color with a dark streak along the middle, extending from the body half-way across, and on this is a golden spot; there are also two golden spots on each wing near the apex.

Besides the raspberry, it feeds upon cherry, grape, currant, rose, corn, sumach, althaea, apple, and I have recently had it sent me as feeding on geraniums. The insect is, however, too rare to be likely to cause any serious injury.

The Red-humped Apple-tree Caterpillar.

17. *Œdemasia concinna* Sm.-Abb.

(Ord. Lepidoptera: Fam. Notodontidæ.)

This is one of the earlier described species of American insects, and the original description occurs in Smith & Abbott's Natural History of the Lepidopterous Insects of Georgia, Vol. 2, p. 169, and is illustrated in plate 85 of that work. Both the larva and the adult are described, the former as feeding on the red-berried alder (*Prinos verticilliatus*). Though its depredations are confined largely to the apple, it also feeds on the blackberry, as stated by Dr. Packard,[24] who also gives the aspen as another food plant, and by Mr. William Beuttenmueller, who gives the full list of food plants as cherry, plum, hawthorne, apple, pear, flowering dog-wood, sweet gum, persimmon, snow-drop tree, bayberry, white, shining and weeping willows, shell-bark, pig-nut and small fruited hickory, and wild blackberry. The species is found from Maine to Oregon.[25]

The caterpillars are gregarious, when very young, and may be observed feeding in clusters on the leaves. They are very peculiar in appearance, the head being coral red with a hump of the same color on the fourth segment of the body, which is traced lengthwise by very narrow, black, yellow and white stripes or lines, with two rows of black tubercles, along the back, and other shorter ones on the sides, from each of which arises a fine hair. The eggs are deposited in a cluster on the under side of leaves. The fore wings of the moth are dark brown on the inner and grayish on the outer margin, with a dot near the middle, a spot near each angle, and several longitudinal streaks along the hind margin, all dark brown. The hind wings of the female are dusky brown; those of the male brownish, or dirty white.

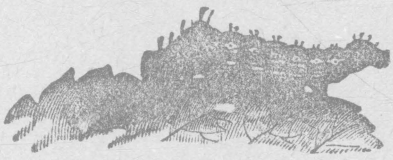

Fig. 4. The Red-humped Apple-tree Caterpillar.

Spraying with arsenites will prove an effective destroyer of these caterpillars.

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[24] Fifth Rep. U. S. Ent. Comm., p. 457.

[25] Entomologica Americana, Vol. 3, p. 157.

18. *Schizura ipomeæ* Doubleday.

(Ord LEPIDOPTERA Fam NOTODONTIDÆ

"The following notes and descriptions are based on an examination of the material in Professor Riley's collection. The larva occurred on the oak September 24. In Virginia one was found by Mr. Koebele, on the birch, September 14, and it has also been bred from the blackberry. The larva makes an earthen cocoon, regularly oval in shape, covering it with sand on the outside, so that it closely resembles that of *Janassa lignicola*. *S unicornis* spins a silken cocoon, with debris collected and adhering to the exterior. It is evident that *C. cinereofrons* Pack. is only a variety of *biguttata*, there being a series of connecting forms in Riley's collection. The moth occurred at Cambridge, Mass., June 16, and in July and August. (Harris)

"Larvæ of this species are found from May to October at St. Louis, Mo., feeding on the different kinds of oak and maple. The moths issued in April and August. The coloration of the larvæ is quite variable, though the most uniform marking is as follows: Color, green speckled with purple. A faint substigmatal sulphur yellow line, most distinct on thoracic joints. A broad pale subdorsal line, between which the dorsum is pale lilaceous, but thickly mottled with rich purple brown and ferruginous, leaving a narrow dorsal line distinctly marked. Two elevated ferruginous warts on top of joints 4 and 11. Head large, pale green, with a distinct lateral black and white stripe.

"Larva.—Differs from *S. unicornis* in the head being purple and having four dark narrow lines extending from the base of the jaws to the vertex; the dorsal spine on the first abdominal segment is nearly three times as large and high as in *S. unicornis*, and ends in a deep fork, each tine of which bears a stiff truncated spine. A pair of dorsal, rounded, small tubercles on each abdominal segment 1-8, those on the 5th and 8th segments being much larger than the others and coral red in color. Coloration much as in *S. unicornis*, but the branches of the V in front of the tubercle on the 8th segment are wider and inclose a broken red line. Meso- and metathoracic segments green; body brick-reddish, slashed with pale lines, with a broad dorsal band forked on the protoracic segment and extending upon the horn on the 1st abdominal segment; behind the horn are four dorsal oval, light patches, each inclosing three red lines. Length 33 mm."

The above is taken from Fifth Rep. U. S. E. Comm., p. 155, and contains a summary of our knowledge of the species.

THE UNICORN PROMINENT.

19. *Schizura unicornis* Sm.-Abb.

(Ord. LEPIDOPTERA Fam NOTODONTIDÆ.)

This is one of the earlier described species of American insects, and was originally recorded from Georgia as feeding, in the larva stage, on the red-berried alder[26]. According to Harris, it is found on plum and apple in August and September. To these food plants Mr. Saunders adds dogwood, rose, alder and winterberry[27]. A number of larvæ were found by me feeding on blackberry in woods near Wooster, Ohio, Oct. 7th.

"The larva is a very singular looking creature. It is reddish brown, variegated with white, on the back, with a large brown head; the sides of the second and

[26]Ins. Inj. Veg., ed. 1862, p. 424.

[27]Insects Inj. Fruits, p. 80.

third segments are green, and from the top of the fourth a prominent horn is projected. There are on the body a few short hairs, scarcely visible to the naked eye; the posterior segment, with the hindermost pair of feet, is always raised when the insect is at rest, but it generally uses these feet in walking. In August and September this larva may be found nearly full grown. At first eating a notch, about the size of its body, in the side of the leaf on which it is feeding, and placing itself in this notch, with the humps on its body somewhat resembling the irregularities in the margin of the partly eaten leaf, it is not easily detected. Eventually it consumes the entire leaf, except a small portion of the base. When mature, it measures from an inch to an inch and a quarter in length, and, while generally solitary in its habits, sometimes three or four are found together eating the leaves of the same twig.

"When full grown, which is towards the end of September, it descends from the tree, and under fallen leaves on the ground constructs a thin, almost transparent, papery cocoon, with bits of leaves attached to the outside. A considerable time elapses after the cocoon is formed before the caterpiller changes to a brown chrysalis. The moth does not appear until the following summer, and is most common in July.

"The fore wings are light brown, variegated with patches of greenish white, with many wavy lines of a dark-brown color, two of which enclose a small whitish space; at the base there is a short blackish mark near the middle; the tip and the outer hind margin are whitish, tinged with red in the males, and near the outer hind angle there are two black dashes and one small white dash. The hind wings of the male are dirty white, with a dusky spot on the inner hind angle, those of the female sometimes entirely dusky. The body is brownish, with two narrow black bands across the front part of the thorax. When the wings are expanded, this moth measures from an inch and a quarter to an inch and a half across. It is double brooded in the South, the moths of the first brood appearing early in June, those of the second in August; in the North it is also sometimes double-brooded."

Dr. Lintner states that the larvæ frequently remain in the cocoon unchanged until spring[28].

"Larvæ found on blackberry were mostly very pale, with the white Y mark on joints 9 and 10 very plain, with much glaucous color about the back, and with the other shades of purple-brown, flesh-brown, olive and pale green, which are found on the withering blackberry bushes, all present. The glaucous and brown colors are especially noticed on the canes of this plant.

"The insect is evidently two-brooded, those of the first brood spinning up at the commencement of July, while larvæ of a second brood, often only about one-fourth grown, are found as late as October 10th.

"The mimicry of the larva when on the blackberry, either stem or leaf, is perfect, and the imitative resemblance of the moth, when at rest, to the bark of a tree is still more striking. The moth always rests head downwards with the legs all drawn together and its wings folded round the body, which is stretched out at an angle of about 45 degrees, the dull gray coloring of the wings with the lichen-green and flesh color giving the whole such a perfect appearance to a piece of rough bark that the deception is perfect.

"Some of the larvæ are, however, infested with *Tachinids* and with *Ophion purgator* Say[29]."

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[28]First Rep. St. Ent., N. Y., p. 137.

[29]Fifth Rep. U. S. E. Comm., p. 269.

The Cecropia Emperor Caterpillar.

20. *Attacus cecropia* (Linn.)

(Ord. Lepidoptera; Saturniidæ.)

The gigantic size and peculiar coloration of this caterpillar (Fig. 6,) will render it easily recognized. It is nearly or quite four inches in

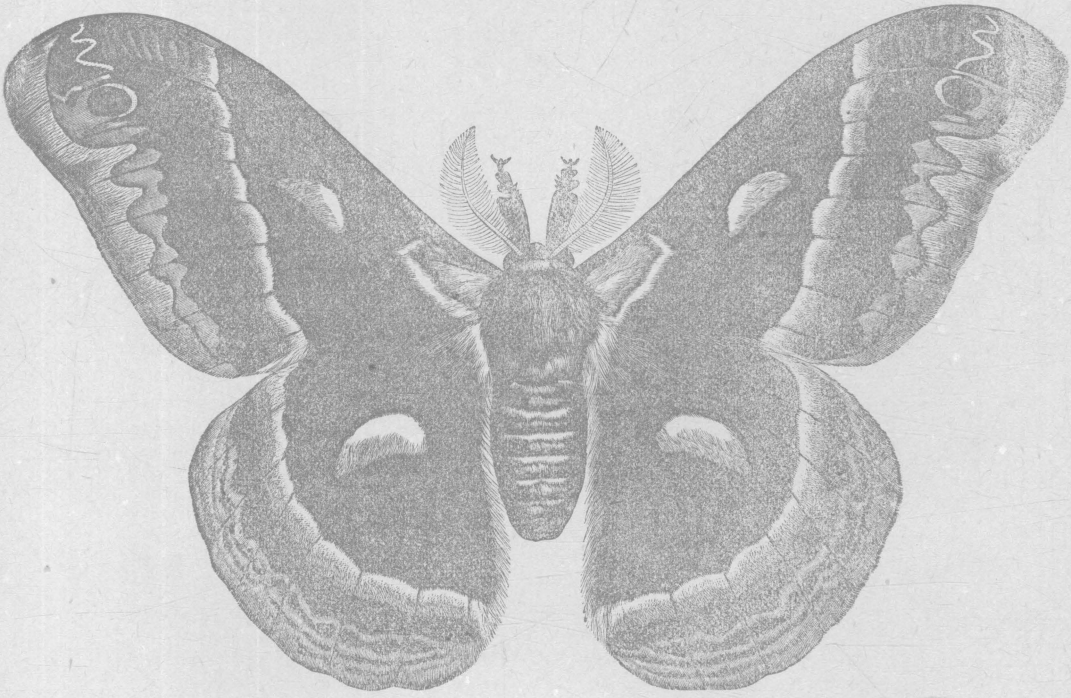

Fig. 5 Cecropia Emperor Moth.

length, of a pale green color and as thick as a man's thumb. On the third and fourth segments are large warts or tubercles of a coral-red color, the others on the back are yellow, except on second and terminal segments which, with smaller ones on the sides, are blue.

"Both the front and hind wings of the adult, (Fig. 5) are of a rich brown, the anterior pair grayish shaded with red, the postrior more uniformly brown, and about the middle of each of the wings is a nearly kidney-shaped white spot, shaded more or less with red, and margined with black. A wavy dull-red band crosses each of the wings, edged within with white, the edging wide and distinct on the hind wings, and more or less faint on the front pair. The outer edges of the wings are of a pale silky brown, in which, on the anterior pair, runs an irregular dull-black line, which on the hind wings is replaced by a double broken band of the same hue. The front wings, next to the shoulders, are dull red, with a curved white and black band, and near their tips is an eye-like spot with a bluish-white

crescent. The upper side of the body and the legs are dull red, with a wide band

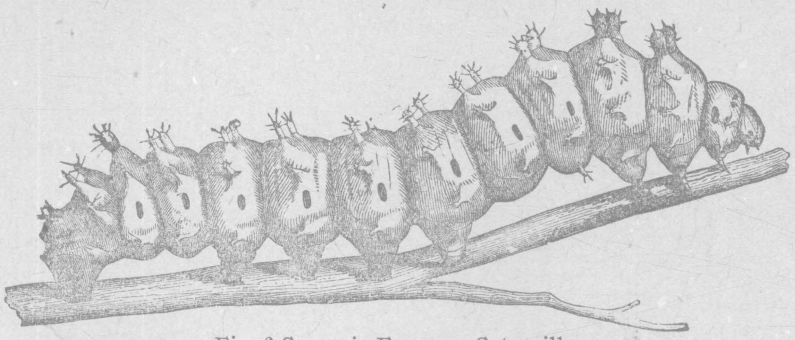

Fig. 6 Cecropia Emperor Caterpillar.

behind the head, and the hinder edges of the rings of the abdomen white; the under side of the body is also marked with white."

"The cocoon (Fig. 7) is about three inches long and an inch or more broad in its widest part, pod-shaped, of a rusty-gray or brownish color; it is formed of two layers of silk, the outer one not unlike strong brown paper, and within this a quantity of loose silken fibres covering an inner, oval, closely-woven cocoon, containing a large brown chrysalis. Snugly enclosed within this double wrapper, the chrysalis remains uninjured by the variations of temperature during the winter. Late in May, or early in June, the pupa-case is ruptured by the struggles of its occupant, and the newly-born moth begins to work its way out of the cocoon; to lessen the labor, a fluid is secreted from about the mouth, which softens the fibres; then a tearing, scraping sound is heard, made by the insect working with the claws on its fore feet, pulling away the softened threads and packing them on each side to make a passage for its body."

Fig. 7. Cocoon of Cecropia Emperor.

Mrs. Dimmock has contributed to Psyche (iv, p. 276) the following historical sketch of this insect.

"*Attacus cecropia*, Linn (Syst. Nat., 1758, ed. 10, p 809. Harris, (Rept. Ins. Injur. Veg., 1841, p. 279–280) describes the larva, imago and cocoon of this species; later (Treatise on Ins. Injur. Veg., 1862, p. 385, 387–389.) he adds figures of the larva, pupa, cocoon and male imago; and still later, (Entom. Corresp., 1869, p. 294–295,) he again describes the larva. Morris, (Synop. Lepid. N. A., 1862, p. 223-224,) describes larva, cocoon, and imago. Trouvelot, (Amer. Nat., March, 1867, v. 1, p. 31,) gives a note on the cocoon. Riley, (Amer. Entom., Feb., 1870, v. 2, p. 97-102, and 4th Ann. Rept. State Entom. Mo., 1872, p. 103-107,) describes the eggs, and figures and describes the larva, pupa, cocoon, and male imago. Sprague, (Can. Entom., April, 1870, v. 2, p. 82,) describes the eggs. Saunders, (Can. Entom., Oct., 1871, v. 3, p. 149-155,) figures and describes the larva, cocoon and male imago. Lintner, (Entom. Contirb., No. 3, 1874, p. 125,) describes the young larva. Worthington, (Can. Entom., Sept., 1876,

v. 8, p. 165-166,) notices some color varieties of the imago. Gentry, (Can. Entom., March, 1877, v. 9, p. 41-49,) describes the egg, different stages of the larva, and cocoon. Grote, (Can. Entom., Sept., 1878, v. 10, p. 176,) says this species is double-brooded in the Southern United States. Packard, (Bull. 7, U. S., Entom. Comm., 1881, p. 113,) figures the larva. Neumoegen, (Papilio, Jan., 1882, v. 2, p. 18,) states that this species usually emerges from the pupal state at about 5 p. m.; Brodie, (op. cit., May, 1882, v. 2, p. 83,) on the contrary, states that the emergence normally takes place about 10 a. m. Riley, and others, state that the larva has five stages, but Wailly, (Bull. Soc. Acclim. France, May, 1882, s. 3, v. 9, p. 266-267,) writes that it has six stages. Brodie, (Papilio, Feb., 1882, v. 2, p. 32-33,) gives a list of 49 species of plants belonging to 20 genera on which the larva will feed; the genera are Tilia, Acer, Negundo, Prunus, Spiraea, Crataegus, Pyrus, Amelanchier, Ribes, Sambucus, Ulmus, Quercus, Fagus, Corylus, Carpinus, Betula, Alnus, Salix, and Populus. From other authors the following genera are compiled: Berberis, Liriodendron, Syringa, Carya, Gleditschia, Rubus, Ceanothus, Ampelopsis, Cephalanthus, Fraxinus, Vaccinum, and Rosa."

The natural enemies of the species are usually sufficient to prevent an invasion of the larvæ. In fact they are seldom seen in numbers sufficient to cause destruction, except perhaps to a single tree or shrub. Birds probably destroy many of them and in winter the cocoons are destroyed by the Hairy Wood-pecker, *Picus villosus*. Besides the birds, the larvæ are destroyed by insect parasites of which six species are known, viz: The long tailed Ophion, *O. macrurum*, Linn, Figs. 8 and 9, the Cecropia Chalcis fly,

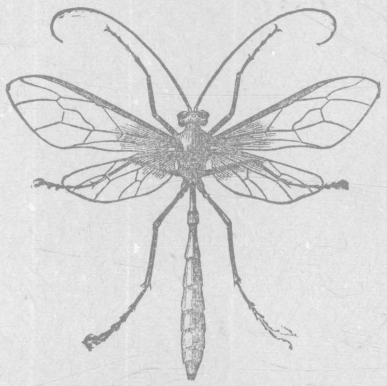

Fig. 8. *Ophion macrum*, Linn. Nat. Size. After Riley.

Smicra mariæ, Riley, Cecropia Cryptus, *C. extrematis*, Cresson, a species of *Tachina* and *Gaurax anchora*, Loew.

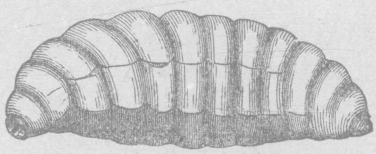

Fig. 9. Larva of *Ophion macrurum*. Enlarged. After Riley.

The Orange-striped Oak-worm.

21. Anisota senatoria Hub.

(Ord. Lepidoptera: Fam. Ceratocampidæ.)

This is another insect which, while exceedingly destructive to other plants, is also a rare depredator on raspberry. The only instance on record, so far as I can learn, where it has chosen the latter food plant is recorded by Dr. Packard from the unpublished notes of C. V. Riley, who received from F. A. Gates, Massillon, Iowa, the female with a batch of 300 eggs on the under side of a raspberry leaf.

These caterpillars are exceedingly destructive to the foliage of various species of oaks, often stripping the leaves from large tracts in the forests. They are spiny, black, with four orange-yellow stripes on the back and two along each side with two black spines above and two on each side.

The moth is ochre-yellow with a large white dot on each fore-wing *Limneria fugitiva*, Say, is a parasite of the caterpillar.

The Californian Tent-Caterpillar.

22. *Clisiocampa californica* Packard.

(Ord Lepidoptera: Fam. Bombycidæ)

Feeding on the scrubby oak, in abundance near San Francisco, a tent-caterpillar with a black head and a double rusty reddish dorsal line, often inclosing a long pale blue median dash, one to each segment; and with two lateral pale blue irregular spots; appearing from the middle of March till the middle of April.

"This species," says Mr. Stretch, (Papilio, vol. i, No. 5,) "is exceedingly abundant in the neighborhood of San Francisco, and is probably widely distributed." Near San Francisco its favorite food-plant is a species of scrubby oak, *Q. agrifolia*, but it is sometimes found on the blackberry (*Rubus*) and other shrubby plants. The larvæ pupate in about six weeks from the egg, and the imago appears in about a fortnight

Caterpillars of the Dagger Moths.

23. *Acronycta spinigera* Guen.

24. *A. brumosa* Grote.

25. *A. xylineformis* Guen.

26. *A. oblinita* Sm. Abb.

(Ord Lepidoptera: Fam Noctuidæ.)

Harris characterizes the larvæ of this genus as living exposed on the leaves of trees and shrubs, having sixteen legs and being cylindrical, more or less hairy, some of them resembling Clostera, having a wart of prominence on the fourth and eleventh segments, some having the hairs in tufts like the Arctians and Liparians. They make tough silken cocoons, in texture almost like stiff brown paper, into which they weave the hairs of their bodies. Their moths have bristle formed antennæ, and the thorax is not crested. Their fore wings are generally light gray with dark spots, and in many are marked with a character resembling the Greek letter *Psi* near the inner angle.

Of *A. spinigera*, Dr. Roland Thaxter gives the following description,[80] and so far as I know, is authority for recording Rubus as one of its food plants:

"Color blackish brown. On each segment are eight warts from which project thick clusters of bristly hairs, three on each side which are single, and two above which are double and larger than the rest. On the first and on the last two segments the hairs are dirty blackish, but on the third the four upper tufts are deep crimson at the base and become black at their extremities; a few crimson hairs in the corresponding tufts of the second segment. On the remaining segments, excepting the last two, the four upper tufts are of a clearer shade of white. The

[80] Psyche, 2, p. 121–2.

remaining tufts are dirty blackish. On the eleventh segment the double warts become each two separate ones, placed longitudinally. Legs black. Head black, with a V-shaped lighter mark. A few lighter blotches above, at the bases of the double warts. Length 40 mm. One, found October 5, spun October 9 a loose cocoon of white silk and changed in two days. The moth appears early in May and in August. It is a rare species in this locality. Larva eats Rubus and Betula."

A. brumosa is given as a raspberry insect by Mr. Saunders whose statements are quoted as follows:

"The caterpillar of this moth, although never yet recorded as very injurious, is more or less common on raspberry bushes every year in some localities. It does not appear in flocks, but feeds singly. It is a grey, hairy caterpillar, which attains full growth during the latter part of July or in August, when it measures, if in motion, about an inch and a quarter long, but when at rest, owing to some of the segments of the body being drawn partly within the others, it does not measure more than an inch. The body is thickest from the third to the seventh segment, tapering a little anteriorly and posteriorly, and is of a brownish-black color, with a transverse row of paler tubercles on each segment, from which spring clusters of brownish-white or greyish hairs of varying lengths. Behind the third segment there is a space down the center of the back where the dark color of the body is distinctly seen. The head is of a shining black color, the upper portion overhung by the long hairs of the next segment. The under side is greenish brown, with a few small clusters of short brown hairs.

"The larva changes to a brown chrysalis within a rather tough cocoon formed of pieces of leaves interwoven with silk.

"The moth has the fore wings grey, mottled with spots, streaks, and dots of darker shades of gray and brown. The hind wings are of a dull pale gray, deepening in color a little towards the outer margin. The under surface is paler than the upper. When the wings are expanded, they measure an inch and a quarter across.

"Should this insect ever become troublesome, it may be subdued by hand-picking, or destroyed by showering the bushes with water in which hellebore or Paris green has been mixed, in the proportion of an ounce of the former or one or two teaspoonfuls of the latter to two gallons of water."

A. xylindriformis.—According to Dr. Thaxter,[31] blackberry is one of the food plants of this species. In his Fifth Report on Insects of Missouri, Dr. Riley has given the larva of this as one of those which possess certain urticating powers, and are commonly known as stinging larvæ. The larva is described as follows:

"Before last molt 1.10 inches long; diameter of middle joints, which are largest, 0.27 inch. Color of body lalaceous, mottled, and transversly dotted with dark brown, and with dark, interrupted, medio-dorsal, subdorsal and stigmatal lines, obsolete on thoracic joints, the medio-dorsal forming a series of Y-marks on the abdominal joints. Each joint with a transverse row of conspicuous warts, concolorous, except the superior abdominal ones, which are ferruginous, becoming paler on anal joints; 8 on jts. 1-3, 10 on the rest, the 4 superior on 11 quadrangularly arranged. Those in subdorsal space largest, more or less confluent, especially on the thoracic and anal joints, and with the space in front of them on abdominal joints, pale. Springing from these warts, a number of stiff, acute, rufous spines, (strongest dorsally) about one-third as long as the diameter of the body, interspersed anteriorly, posteriorly and laterly with much longer bristles. Stigmata oval

[31] Papilio 3, p. 17.

and bright yellow, (black in alcoholic specimen). Head small, dark copal-colored, with a yellow triangle in front. Venter concolorous, the legless joints with four small verrucose warts. Thoracic legs same color as head; prolegs same as body, both furnished with stiff, yellow hairs. The tips of spines are more or less black, as are the points on the warts from which they spring.

"After last molt the warts are paler, except on joint 4, where they remain dark red, the subdorsal pale spaces in front of the confluent warts become more conspicuous, and are strongly relieved by the broadening of the dorsal and subdorsal dark lines, the Y-shape of the former being nearly obliterated.

"Four specimens. Feeds on oak, willow and rose, and I have also found it on *Rhus toxicodendron*, persimmon and peach.

"Spins a dirty white, elongate, thin and compact cocoon within a leaf.

A. oblinita. The larva of this species was found by me feeding on the foliage of raspberry in my garden in Wooster, Ohio, in July.

Dr. Riley describes it in the following terms

"The larva is easily recognized by the distinct wavy bright yellow band at the side, and the transverse row of crimson-red warts and stiff yellowish or rust-red bristles across each joint, in contrast with the black color of the body. When full grown it draws a few leaves or stems together, or retreats into some fence corner, and spins a narrow elongated cocoon generally white, but occasionally inclining to ochre-yellow, some which I have found on willow being of this last color. The chrysalis is very dark brown, and, with the exception of a smooth shiny band on the posterior border of each abdominal joint, is rough and shagreened. It has the power of violently turning round and round in its cocoon when disturbed, thereby causing a rustling noise. The moth has the front wings of an ash-gray color, caused by innumerable dark atoms scattered over a white ground, and there is a distinct row of black dots along the posterior border, a more or less distinct black zigzag line across the outer fourth, and some dusky spots just above the middle of the wing The hind wings are pure white.

"There are two broods each year, the first brood of worms appearing for the most part during June, and giving out the moths in July, and the second brood occurring in the fall, passing the winter in the chrysalis state, and producing moths the following May".[32]

The same author gives *Ichneumon unifasciatorius* Say, *Aleiodes Rileyi* Cresson and a species of *Polysphincta* as parasites of the larva; and asparagus, cotton, smart-weed, apple, peach (?) and willow as its food plants.

The Black Army Worm.

27. *Noctua fennica* Tausch.

(Odr LEPIDOPTERA: Fam NOCTUIDÆ)

This is one of the cut-worms, and until within a few years has been a rather rare insect. I do not know of its occurrence in Ohio, but its appearance in the northern portion of the state would not be surprising. Its habitat, as now known, is from New York to Alaska, and it has been especially abundant and destructive in northern Michigan and Canada In its food habits it appears almost omniverous, which fact, but for its appearance in great hordes like the true army-worm, would indicate that it would likely prove injurious only to a limited extent. But it seems to have caused great destruction in Michigan in 1883.[33]

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[32] Third Rep. Ins. Mo., p. 70.

The following year it was very destructive about Ottawa, Canada,[34] but 1885 did not witness a re-appearance. Mr. Fletcher states that the larva is primarily a clover insect, but that he has found it when abundant, destroying raspberries, strawberries and asparagus.[35]

Prof. Cook reared a parasite fly, *Scopolia sequax* Williston, in Michigan, from the worm, a description of which, together with that of the larva itself, will be found in Report of State Horticultural Society for 1884, p. 83. He also found that they could be destroyed by arsenical poisons. Coal-tar water was found to repel them.

The Stalk Borer: Heart Worm.

28. *Hydræcia nitela* Guen.

(Ord. Lepidoptesa : Fam. Noctindæ.)

The species was described in 1852,[36] though the depredations of its larvæ, unknown as such, had attracted the attention of Dr. Harris as early as 1848, who observed it burrowing in potato stalks and described it in that connection.[37] There is, however, good evidence of its destructive habits in wheat, long prior to this date. Mr. Jabez Jenkins, of West Whiteland, Chester county, (Pa.?) observed its work in wheat straw and called attention thereto in 1840,[38] while Mr. Thos. Beesley writing from Cape May June 27th., 1823, speaks of a worm which eats into the "straw at the second or third joint."[39]

As previously stated, the injury to the smaller cereal grains is usually very slight and mostly confined to the margins bordering on grass lands. One case is, however, on record where serious injury was sustained to a small field of wheat near Madison, Wisconsin, where the grain was entirely ruined.[40]

The full life history of the species is not known, but it is supposed to pass the winter in the adult stage. At any rate we have found very young larvæ working in the stems of young oats, below the surface of the ground in April, in central Illinois, the field having been devoted to corn the previous year.[40]*

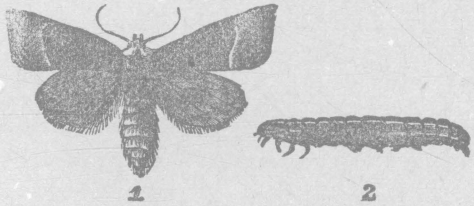

Fig. 10. 1. Adult of Stalk-borer; 2. Stalk-borer.

The worms are, when young, of a livid hue with light stripes along the body,

[33] Report Mich. Hort. Society, 1884, pp. 81-2.
[34] Fletcher, Rept. Ent. Dept. Agr. Can., 1885, p. 11.
[35] Insect life, Vol. 3, p. 247.
[36] Sp. Gen. Lep. V.,Noct. i, 1852, p. 124.
[37] Entomolgical Correspondence, p. 315.
[38] Farmers Cabinet, Vol. 5, p. 68, 1840.
[39] American Farmer, Vol. 5, p. 165.
[40] LeBaron, Second Rep. State Ent. Ill., p. 141.

the one on the side being interrupted toward the head (See 2, Fig 10). The moth is of a general mouse gray color with a light band on each fore wing as shown in the figure. There is no known remedy for these insects in the fields, and cutting out is resorted to in case the plant is a valuable one, in the garden and lawn. Prof. J. A. Lintner[41] records a single instance where the larva so far departs from its normal habit as to become an external feeder, in this manner depredating upon corn.

Besides grain, it is known to bore in the stems of the following plants: tomato, potato, spinach, dahlias, asters, lilies, spiraea, salvia, thistle, milk-weed, castor-bean, rhubarb, cockle-bur, rag-weed, pig-weed, smart-weed, and twigs of apple, peach, currant and blackberry.

The Pyramidal Grape-vine Caterpillar.

29. *Pyrophila pyramidoides* Guen.

(Ord Lepidoptera Fam Noctuidæ)

The larva is a large, naked caterpillar when full grown nearly an inch and a half in length, tapering toward the front and thickened behind. Head small, whitish green, mandibles tipped with black, body also whitish green, darker at sides, with white stripe down the back, widening behind and slightly broken between segments, a bright yellow stripe on each side and a second of same color but fainter, half way between this and one on back, more distinct posteriorly and following the peculiar shape of the twelfth segment. The moth is quite large, the fore wings are dark brown shaded with paler brown and dots and wavy dull-white lines. The hind wings are reddish, with coppery lustre, becoming brown on outer angles of the front edge and paler toward the hinder and inner angles. Besides the raspberry, the larvæ feed on thorn, plum, red bud, poplar and grape, according to Riley,[42] while I have reared it from the strawberry, and have found the moths secreted in abundance under loose bark in the woods in late summer.

30. *Scopelosoma sidus* Guen.

(Ord Lepidoptera Fam Noctuidæ)

"This is one of the earliest noctuids of the season. Specimens which were captured March 24, 1884, at sugar, commenced to deposit their eggs the following day, the larvæ hatching therefrom in about fifteen days Not finding any leaves they commenced at once to attack the leaf-buds of oak, wild cherry, apple, peach, and perhaps other trees and shrubs, into which they bore.

"The larvæ commence entering the ground by about the 10th of May, and the moths emerge from the last of September to the early part of November, many however, remaining as pupae till the next spring

"Larvæ of the species were found in May by Prof. C V. Riley at St. Louis, Mo., feeding on blackberry, the moth issuing in October

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*[40] Rep Comm Agr, 1884, p. 392

[41] New England Farmer, July 13, 1889.

[42] Third Rep. Ins Mo., p. 72

"Eggs.—Globular, with numerous fine ridges, of a yellowish white, which gradually changes into a light brownish color.

"The newly hatched larvæ are whitish with black head and dusky thoracic plate and legs. The first molt takes place about seven days after hatching, and with it there is quite a change in coloration. The thoracic segments, a broad lateral stripe, and the anal segment are reddish. The warts are prominent, black, bearing a short, fine hair.

"After four to six days the second skin is cast and the color has become still darker. Head honey yellow. Cervical shield polished black. Thoracic and first abdominal segment brownish. Dorsal space light green or whitish, with the medial line and subdorsal stripe white, a brown line above stigmata and broad white lateral line. Venter light green. Piliferous warts white, furnished with a fine, short, pale hair.

"Four or five days later the fourth and fifth molts take place."[43]

The Raspberry Geometer.

31. *Synchlora glancaria* Guen.

(Ord Lepidoptera Fam Glometrid æ)

This is one of the geometers, or measuring worms, as they are more commonly known. It was first brought to notice by Dr. Riley in 1868, and from his report the following is extracted.[44] Though termed a raspberry insect, it affects both the fruit of this and the blackberry.

"This caterpillar was quite numerous last summer (1867) on both the above named fruits at South Pass, Illinois. It has the peculiar faculty of thoroughly disguising itself with pieces of dried berry, seed, pollen, and other debris of the fruit, which it sticks to a series of prickles with which it is furnished. Add to this disguise the habit which it has of looping itself into a small ball, and it almost defies detection. It is most numerous during the months of June and July. Through the kindness of Mr. T. A. E. Holcomb, of South Pass, I was enabled to breed this insect to the perfect state. From two specimens of the larvæ which he sent me, I bred from one, July 9th, the other being infested with a parasite which formed a tough cocoon, very much like that of a parasitic fly (*Campoplex fugitivus*, Say), which I have bred from milkweed feeding larvæ of *Euchoetus egle*, Harris. This little moth is of a delicate light grass-green color, with two paler lines running across both wings as in the figure."

"APLODES RUBIVORA, N. Sp.—Larva.—Average length 0.80. Color light yellowish-gray, darker just behind each joint, and very minutely shagreened all over. On each segment a prominent pointed straight projection each side of dorsum, and several minor warts and prickles below. Two very slightly raised, longitudinal lighter lines along the dorsum, between the prominent prickles. Ten legs.

"Perfect insect.—Alar expanse 0.50; length of body 0.25. Color verdigris-green, the scales being sparse so that the wings appear subhyaline. Fore-wings with two transverse lighter lines dividing the wing into three parts, proportionate in width as 3, 4, 2 counting from base, and parallel with a posterior margin; also a faint line between these two running to about $\frac{1}{3}$ of wing from costa. Hind wings with two similar transverse lines, dividing the wing in like proportion, the outer line not parallel with margin, but wavy and produced posteriorly near its middle, Costa pale; fringes obsolete. Head, thorax and abdomen green above, but, together with antennæ and palpi, white beneath."

"Described from one specimen." It has since been found that this is *Synchlora glancria*, Guen.

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[43] Fifth Rep. U. S. E. Comm., p. 116.

[44] Riley's First Rep. Ins. Mo., p. 139, Plate 2, Fig. 25.

THE CHAIN-DOTTED GEOMETER.

32. *Caterva catenaria* Cramer.

(Ord LEPIDOPTERA Fam. GEOMETRIDÆ)

According to Dr. Packard, "This common moth (Fig. 11, c. d.) is easily recognized by its large size, the snow-white, thin wings. Head ochreous-yellow in front. Thorax yellowish at the base of the patagia. Fore wings white with a black, narrow

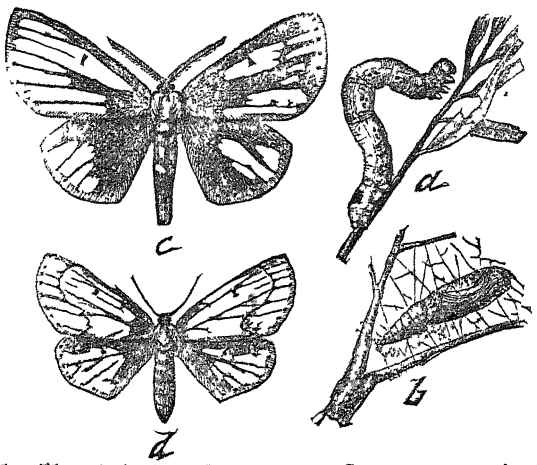

Fig. 11. The chain-dotted Geometer, *Caterva catenaria* Cramer, c. male; d. female, a larva; b. pupa. All natural size, after Riley.

zigzag line on the inner third of the wing; the line is more or less obsolete, often having venular dots. A distinct discal spot. A scalloped, black line half-way between the discal dot and the outer edge. Fringe checkered with black dots. Male antennæ very plumose. End of male abdomen yellowish."

"It is single brooded, not appearing until about the middle of September, and flying until the middle of October in the New England states."[45]

On some occasions these moths appear in enormous numbers. An instance is recorded where[46] their numbers were so great and the mass so dense in some places, that it appeared like a snow storm, and alarmed the farmers, who erroneously supposed them to be the progenitors of the army worm.

Description of larva, (Fig. 11 a.)—"Head of the same width as the prothoracic segment, divided by a slight median crease into two lobes. The body is cylindrical, of uniform width throughout, a little thicker over the first pair of abdominal feet; pale straw-yellow. Two subdorsal brown hair-lines, and two similar ones on the sides, interrupted by two, large, conspicuous, angular, black dots,—a pair on each ring. Beneath, three hair-lines on each side of the body. The head and prolegs are dotted with black. Length, 1.50 inches. It feeds in Maine on *Carex pennsylvanica*, and has been found, August 1–14, in Danvers, Mass., by Mr. Gray, feeding upon the blackberry, wood-wax, wild indigo, etc., transforming into the pupa August 14, previously spinning a slight but well formed web of yellow threads among the leaves."

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[45] Monograph of Geometrid Moths, p. 217.

[46] Rep. Comm. Agr., 1880, p. 274.

Dr. Riley received the larva from Miss Marion Hobart of Port Byron, Ill., who found it feeding upon the hazel.[47]

THE RASPBERRY PLUME-MOTH.

33. *Oxyptilus tenuidactylus* Fitch.

(Ord LEPIDOPTERA Fam. PTEROPHORIDÆ)

This is the species mentioned by Mr. Saunders on page 314 of his Insects Injurious to Fruits, and of which he speaks as follows:

"About the middle of June the larva reaches full growth when it is about four-tenths of an inch long, of a pale yellowish-green color, streaked with pale yellow, and with transverse rows of shining tubercles, from each of which arise from two to six spreading hairs of a yellowish-green color. The head is small, pale green, with a faint brown dot on each side.

Fig 12
The Raspberry Plume-moth.

"When the larva is about to change to a chrysalis, it spins a loose web of silk on a leaf or other suitable spot, to which the chrysalis is attached. This is less than three-tenths of an inch long, pointed behind, enlarging gradually towards the front, where, near the end, it slopes abruptly to the tip. Its color is pale green, with a line along the back of a deeper shade, margined on each side with a whitish ridge; it is also more or less hairy. In about a week or ten days the chrysalis changes to a darker color, shortly after which the perfect insect escapes.

"The moth (Fig. 12.) although quite small, is very beautiful; it measures, when its wings are expanded, about half an inch across. The fore-wings are of a deep brownish-copper color, with a metallic lustre, and a few dots of silvery white, they are cleft down the middle about half their depth, the division as well as the outer edge being fringed. The hind wings, which resemble the fore wings in color, are divided into three portions, the hinder one being almost linear, and all deeply fringed. The antennæ are ringed with silvery white, and there are spots of the same color on the legs and body."

34. *Cacœcia rosana* Linn.

(Ord. LEPIDOPTERA: Fam TORTRICIDÆ.)

This is a leaf-roller, occurring in both Europe and America. The only record I have of its feeding habits is included in Prof. Fernald's Synonymical Catalogue of the described Tortricidæ of North America north of Mexico,[48] where the food plants are given as "apple, elm, willow, birch, wild rose, raspberry, hazel, linden, aspen, hawthorne, currant and gooseberry in Europe, and currant in America (Jas. Angus.")

It is not likely to become seriously destructive.

THE GRAPE-BERRY MOTH.

35. *Eudemis botrana* Schiff.

(Ord LEPIDOPTERA. Fam GRAPHOLITHIDÆ.)

This has long been known as a serious pest in the vineyards of

[47] Am Ent, 2, p. 179.

[48] Trans. Am. Ent. Soc., X, p. 11.

southern Europe, and was described in 1776.[49] Dr. Clemens gave its food plants in 1860, as wild raspberry, sassafras.[50] In 1870 Dr. Riley received it from Mr. A. S. Fulier, it having emerged in transit from New Jersey. Mr. Fuller sending the larvæ which he accused of injuring the blossoms of blackberry.[51] As a grape insect, Ohio has had her full share of trouble, one of its earliest appearances in this sort of depredation having been reported from Mr. M. C. Read of Hudson, about 1866 or 1867 and again in 1868. It was seriously destructive in the vicinity of Cleveland about this time, in some instances fifty per cent of the grape crop being ruined by depredations of the larvæ.[52]

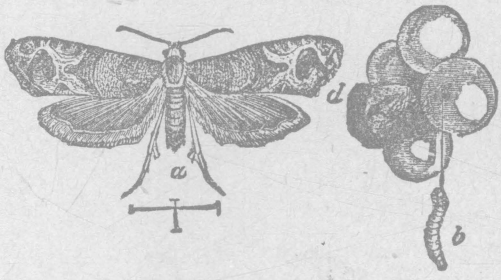

Fig. 13. The Grape-berry moth. *Eudemis botrana*. *a*, Adult: *b*, larva; *d*, injured fruit. After Riley.

The moth is shown at Fig. 13, *a*; the larva at *b*, and *d* illustrates its effect on the grape, *c* showing healthy fruit. The moth is deep brown, pale buff and slaty, the larva olive-green or brownish. When disturbed the latter will wiggle out of the fruit and let itself downward as illustrated in the figure. The larvæ are first observed early in July, and after becoming full fed they cut out a flap from the leaf and folding it over construct a cocoon in the enclosure. It is supposed that the larger portion of the larvæ winter over in their cocoons on the leaves which fall to the ground in the fall. Hence the practical method of prevention is to gather up and burn the fallen leaves in winter or early spring.

As an aid to those who may wish to refer to the published record of the species, it may be stated that it will be found under the following names: *Tortrix botrana* Schiff, *Phalaena vitisana* Jacq., *Cochylis reliquana* Treits, *Lobesia reliquana* Wilk., *Endopiza viteana* Clem., *Penthina vitivorana* Pack.

The Raspberry-Leaf Roller.

36. *Exartema permundana* Clem.

(Ord. Lepidoptera: Fam. Grapholithidæ.)

Dr. Packard has called this the Hickory Eccopsis, because he reared it from larva which fed on the leaves of the white-heart hickory (*Carya tomentosa*), and gives the life history for southern New England as follows: From eggs laid the previous autumn on the twigs, the insect being probably double brooded, the caterpillars hatch out simultaneously with

[49] W. V. p. 131, No. 26.
[50] Proc. Acad. Sci. Phil., 1860, p. 359.
[51] Am. Ent., Vol. 2, p. 307.
[52] Loc. cit., p. 178.

the opening of the leaves in spring, living about a week or ten days in this state between the folded leaves or rolling them up sideways or from the apex to the base; in the fold or roll thus made, which it lines with silk, it changes to a chrysalis, remaining about a fortnight in this state until in the third week in June, in southern New England, it appeares as a beautifully marked moth flying about and resting on the leaves.[53] Mr. Coquillette states that in Illinois[54] the larvæ feed on Siberian crab-apple, raspberry, wild blackberry and hazel, larvæ being found May 30th. Dr. Clemens first discovered the insect feeding on Spiraea,[55] while Prof. Fernald has reared it from both this and raspberry, and it was at one time quite injurious to the latter about Ithaca, N. Y. I reared the adults at LaFayette, Indiana, from larvæ found May 1st in the folded leaves of the Snyder blackberry. These larvæ pupated on the 9th and adults emerged on the 21st.

The full grown larva is about five-eighth of an inch long, of a dark green color, the head and thoracic plate being pitchy black. On being disturbed they wiggle out of their home among the rolled leaves and let themselves down by a silken web.

The moth has an expanse of wing of half an inch. The fore wings are dull yellowish or greenish brown, varying much in color, with irregular lighter markings crossing the wings obliquely. Hind wings ashy brown.

It is quite probable that the larvæ may be destroyed by the use of hellebore or by spraying with a weak solution of the arsenites.

The Bud-Moth.

37. *Tmetocera ocellana* (S. V.)

(Ord Lepidoptera Fam. Grapholithidæ.)

Prof. Fernald has treated this species so fully in his bulletin[56] that I copy his paper in full.

"This species was first described briefly by the authors of the Vienna Verzeichniss in 1776, page 130, under the name of *Tortrix ocellana*, and in the Supplement to the same report, page 318, they state that the larva feeds on horn-beam (*Carpinus betulus*). Fabricius described the moth more fully in his Mantissa Insectorum, volume 2, page 228, (1887), and in 1794, in part 2, volume 3, of his Entomologica Systematica, page 255, he described the moth again under the name of *Pyralis luscana*. Why he changed the name is not apparent.

"Hübner, sometime before 1811, in his Sammlung Europäischer Schmetterlinge, figured this species on plate 3, figure 16, and gave it the name of *Tortrix comitana*, and in his Geschichte Europäischer Schmetterlinge, Tortrices, gives on plate 3, fig. 1, a, the larva; and b, the pupa, on apple blossoms.

"Bechstein, in his Naturgeschichte der schädlichen Forstinseckten, part 3, page 774, (1805), describes the moth and says that it is seen rarely in forests in Ger-

[53] Fifth Rep. U. S. Ent. Comm., p. 312.

[54] Papilio, Vol. 3, p. 102.

[55] Rep. Comm. Agr. 1880, p. 267.

[56] Hatch Expt. Sta. Bull. 13, pp. 4-9, Apr., 1891.

many in the month of June; and that the Vienna Verzeichniss states that the larva feeds on the white beach, (*Fagus sylvaticus*), thus making a mistake in the food plant by misquotation.

"Haworth, in his Insecta Britannica, part 3, page 334, published in 1811, adopts Hübner's name and describes six different varieties of the moth, but makes no allusion to the early stages and food plants, which he would have done if he had known them, for, on the title page, he states that all known facts on the early stages are given.

"Froelich, in his Enumeratio Tortricum, published in Germany in 1828, describes the moth but makes no allusion to the early stages.

"Treitschke, in Die Schmetterlinge von Europa, volume 8, page 40, (1830), describes this moth under the name of *Penthina ocellana*, and in the supplement, part 3, page 51, (1835), it is stated by Herr Moritz that there are two varieties; one with the middle of the fore wing wholly white, the caterpillar of which lives in *Sorbus aucuparia*. It is pale reddish gray, with black head and thoracic shield Of a darker variety, the pupæ have been found only on alder, but they probably live on other kinds of trees. In July the moths are frequently found in larch forests.

"Stephens, in his Illustrations, volume 4, page 92, (1834), describes this moth under the name of *Spilonota comitana*. He states that it is extremely abundant in the vicinity of London, and not uncommon in other parts of the country. The caterpillar feeds on the hornbeam, and the moth appears on the wing about the middle of June.

"Duponchel, in the Histoire Naturelle des Lépidoptères, Tome 6, page 203, (1834), described the moth under the name *Penthina luscana*, and referred to the account of the food plant given in the Vienna Verzeichniss, already mentioned.

"Schmidberger, in Kollar's Insects Injurious to Fruit Trees, page 234, (1840), describes this insect under the name *Tortrix* (*Penthina*) *ocellana*, but gives no description of the larva. He states that the eggs are laid singly on the fruit buds or leaf buds, during the month of June [in Austria], and that they do not hatch till the following spring, when the larva reaches its full size in four or five weeks, then pupates and emerges in May as a moth.

"Guéneé, in his Index Methodicus, page 20, (1845), in a foot-note, says the larva is brownish with a black head and shield, and that it lives in the month of May in the topmost leaves of *Alnus*, twisted and drawn together.

"Zeller, in Oken's Isis for 1846, describes the full grown larva very briefly and states that it feeds on oak and alder.

"Herrich-Shäffer, in his Schmetterlinge von Europa, volume 4, page 234, (1849), says that it is on the wing at the end of June, and that the large light examples are from fruit trees, and that the smaller darker ones are from larch, the larvæ being between the leaves.

"Stainton, in his Manual of the British Butterflies and Moths, volume 2, page 219, (1859), describes the moth under the name of *Hedya ocellana*, and says the larva is brown with the head and second segment black, and feeds "on various trees," "very common in the south of England but scarcer towards the north." Wilkinson, in his British Tortrices, published in the same year, describes it under the same name, and says the imago emerges in June and July, frequenting hedges and woods around London; and that the larva feeds on hornbeam, alder, mountain ash and probably on whitethorn. He repeats the description of the larva given by Guéneé.

"Lederer, in 1859, in his Revision of the European Tortricids, page 367, established the generic name *Tmetocera* for this species, because of the notch in the upper side of the base of the antennæ of the male.

"Heinemann, in his Tortricina of Germany and Switzerland, page 206, (1883), after describing the moth, states that the larvæ occur in May and June, on fruit and other deciduous trees, and the variety *laricana*, between the needles of the larch.

"Zeller, in the Entomologische Zeitung for 1873, page 129, describes his variety *laricana*, but gives nothing new of the larva *Tmetocera ocellana* or of the larva of this variety.

"I have two examples of the European variety *laricana* in my collection, but have never seen anything like them taken in this country, nor have I heard that any one here has bred *T. ocellana* larva or any variety of it from larch.

"Taschenberg, in his work on Entomology for gardeners, published in Bremen in 1874, page 306, says that this species is very abundant everywhere, on the wing from June to August, and further says the caterpillar has sixteen feet, is reddish brown with head blackish, in early spring upon the buds of different kinds of deciduous trees, and also upon apple and pear trees. In his further account he follows the statement of Schmidberger in Kollar's Insects, given above, and adds a list of five different species of Hymenopterous parasites that prey upon it.

"The first account given of it in this country, so far as I can learn, was that by Harris in his Insects Injurious to Vegetation, First Edition, page 349, (1841), where he describes it under the name of *Penthina oculana*, but he does not give the early stages.

"In 1860, Clemens describes this species in the Proceedings of the Philadelphia Academy of Natural Sciences, page 357, under the name *Hedya Pyrifoliana*. His description of the moth and also of the larva is very good, and he says "it inhabits the pear and plum trees."

"Since that time many persons have written about it more or less fully, but nothing new has been given on its habits, so far as I have seen, and it has generally been supposed to pass the winter in the egg state. Mr. James Fletcher, in his Report for 1885 as Entomologist to the Department of Agriculture of Canada, page 24, writes, "I do not know for certain the life history of this little moth, but believe it passes the winter as a larva on the branches of apple trees, protected by a covering of silk"

"For some years past I have observed the habits of this insect, and have been able to carry it through its transformations. The moths emerge between the last of June and the middle of July, though belated specimens are sometimes taken on the wing as late as the middle of August, and one was taken at this place August 25, 1889.

"The fore wings expand about three-fifths of an inch. The head, thorax, and basal third of the fore wings, and also the outer edge and fringe are dark ash gray, the middle of the fore wings is cream white, marked more or less with costal streaks of gray, and in some specimens this part is ashy gray, but little lighter than the base Just before the anal angle are two short horizontal black dashes followed by a vertical streak of lead-blue, and there are three or four similar black dashes before the apex, also followed by a streak of lead-blue.

"The hind wings above and below and the abdomen are ashy gray. The under side of the fore wings is darker, and has a series of light costal streaks on the outer part.

"The moths pair and the female lays her eggs, when in confinement, in clusters of from four to ten or eleven, often overlapping each other. They are oval, flattened, four-fifths of a millimeter long, and half as wide, sordid white with a narrow border of clear transparent white, while the center of the eggs is one complete mass of minute granules. In about three days the center of the egg has grown darker, and the granules larger; and on either side there is a clear, white, oval space about one-third the length of the egg. In about two days more the outer edge of the center is the same color as in the last stage, and inside this is a narrow, lighter band, while in the center is seen the form of a cylindrical larva larger at one end, and both ends slightly curved towards each other; and in one or two days more the whole form of the larva is visible, the head, thoracic and anal shields being black. The egg stage lasts from eight to eleven days.

"When the young larva hatches it does not eat the shell of its egg, but goes on to the tenderest leaves and almost immediately begins spinning a microscopic layer of silk, under which it eats the outer layer or epidermis of the leaf. The larva is then about three millimeters in length, of a creamy white color, with head, thoracic and anal shields blackish brown, and a few minute pale hairs on the body; the head is very large for the rest of the body. In a week the larva is nearly four millimeters long, light yellowish brown, with the head, thoracic and anal shields dark brown, and it eats minute holes through the leaf, its silken web now being visible to the naked eye. The larva gradually becomes a trifle more brownish, increases in size and enlarges its web along the side of the midrib.

"Late in the fall the silken web is quite heavy and thick, and the larva deposits its excrements in little black pellets in the form of a tube, under the web, within which it hibernates during the winter. Not unfrequently two leaves are fastened together by the silk of the web, and sometimes a leaf is secured to a branch of the tree in the same manner.

"About the first of May the larva measures seven millimeters when resting, and eight when in motion. It is cylindrical in form, with the head dark brown and of medium size. The body is dark yellowish brown, and the head, thoracic and anal shields very dark, polished brown. There are ten lighter brown protuberances on each segment, from each of which arises one pale hair. On the upper surface of the ninth segment is seen the double undeveloped reproductive organ of a light brown color. The legs are dark brown and the prolegs yellowish brown. About the first of June the larva is from ten to twelve millimeters in length, and the body has changed to a cinnamon rufous color. From the middle to the last of June it curls or draws together several leaves which it lines with silk, and in which it tranforms to a pupa.

"The pupa is seven millimeters long, brownish yellow, tapering from the head to the posterior end, with the wing cases dark brown. There are two rows of dark brown spines pointing backwards, across each abdominal segment. The spiracles and anal segment are dark brown. It remains in the pupa stage about two weeks and then the moth emerges.

"Some years ago I found a most curious parasite attacking the larva of this species. It was a Hymenopterous insect of a pea green color, and was attached to the top and across the second segment of the larva, on the outside and entirely out of the way of harm, and there it grew fat at the expense of its host which died a lingering death. The parasite was determined for me by Mr. E. T. Cresson as *Phytoductus vulgaris* Cr.

"The following food plants are reported for this country: apple, pear, plum, cherry, laurel-oak, and Prof. Harvey informs me that he has bred it from blackberry.

"The food plants given in Europe are apple, pear, quince, Carpinus, Crataegus, Sorbus and Quercus.

"To destroy these caterpillars it is desirable to gather all the leaves from under the infested trees in the fall and burn them, and also to shower the trees with one pound of paris green in one hundred and fifty gallons of water, in the spring when the buds first begin to swell."

Leaf Roller.

38. *Phoxopteris* sp.?

(Ord. Lepidoptera. Fam. Grapholithidæ).

In a paper read before the Association of Economic Entomologists at the Rochester meeting, Prof. John B. Smith stated that he had found the larvæ of species of this genius quite common on blackberry in New Jersey, but had not noticed it in previous years. It did not, however, do any serious injury.

The Blackberry Leaf-Miner.

39. *Nepticula rubifoliella* Zell.

(Ord Lepidoptera Fam Nepticulidæ)

This is a minute species, the adult of which is describes as follows:

"Head dark luteous. Palpi somewhat paler luteous. Antennæ luteous, basal joint silvery-white. Fore-wings blackish-brown, with a rather narrow, curved, silvery band about the middle of the wing. The band is concave toward the base of the wing and shows a tendency to be interrupted in the middle. Cilia whitish. Hind-wings grayish, cilia the same."

Of the larva Dr. Clemens makes the following statement:

"The larva mines the leaf of blackberry in September. It makes a blotch mine on the upper surface of the leaf, beginning as a slender gallery, extending quite a distance, usually along a vein of the leaf, before being enlarged into a blotch. The body of the larva tapers posteriorly, the terminal rings being attenuated; color pale green, with a bright dark-green vascular line; head greenish-brown and small. The larva was not taken from the mine for description. It leaves the mine very early in October to spin an oval, very dark reddish brown cocoon, and appears as an imago during the latter part of May, or early in June. There is therefore, in all probability, a summer brood, which may be found in July and August, if the conjecture is correct."[57]

The Case-Bearing Blackberry Leaf-Miner.

40. *Nepticula villosella* Clem.

(Ord. Lepidoptera Fam Nepticulidæ.)

Dr. Clemens says that the larvæ of this species should be sought for during the latter part of June to middle of July in leaves of blackberry, and describes the mine and larva briefly in the following[58] terms.

"The mine is very narrow, only about wide enough to accomodate the miner, tortuous, with a central frass line. The larva is pale brownish and leaves its mine during the latter part of July.

"This differs from *N. rubifoliella* both in the mine and color of the larva."

As the publications containing Dr. Clemens' writings are too rare to be within reach of a majority of Station entomologists, I take the liberty of transcribing a couple of paragraphs relating to the habits of the larvæ of Coleophora and some hints in relation to rearing them artificially.

"The young larvæ feed either as miners in the interior of leaves or in the interior of seeds. When a leaf-mining larva has attained a certain age, it cuts out the two skins of the mined place and constructs of it a portable case, which it never abandons subsequently, except to construct a new one, when its increase in growth demands the change. In feeding the larva attaches its case to a leaf and bores into it between its skins, eating out a transparent patch, extending its body from the case for this purpose, but quickly retreats into it again, if alarmed."[59]

"Coleophora larvæ do not bear well confinement in the humid air of the breeding jar. To be successful in rearing the larvæ, one must use a pot of moistened

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[57] Tineina of N. A., by B. Clemens, ed. by Stainton, p. 152; Proc. Acad. Nat. Sci., Phila., 1860, pp. 203-221.

[58] Tineina of N. A., p. 164.

[59] Loc. cit., p. 165.

sand in which the food plant is placed, covered with a glass cylinder, with fine gauze tied over the top; the plant may be kept in water and covered with a cylinder of glass. For this purpose old chimney tops to lamps answer very well. The larvæ of this genus, taken in the fall of the year, hibernate in their cases until the following spring, and "feed up" on the first leaves that put forth. They must not, therefore, be kept in a warm room during the winter. The pupæ of the fall brood of larvæ thrive much better, likewise, if not kept in a warm room during the cold months. The spring or early summer brood of larvæ produce imagos in a few weeks after entering the pupa state, and hence it is much more satisfactory to collect early in the year than during the latter part."[60]

The following lepidopterous larvæ are recorded as depredating on Rubus;

41. *Sesia hemizonæ* Hy. Edw.

Root and stems, J. J. Rivers, Papilio 3, p. 26.

42. *Apatelodes torrefacta* Sm.-Abb.

This is described in Lep. Ins. Georgia, p. 151, and figured in Plate 76, 1797. Dr. Harris describes the larva of "*Astasia torrefacta*? Sm.-Abb." Ent. Corr., p. 307. Packard gives locality, New York (Grote), and Boston (Sanborn), Proc. Ent. Soc. Phila., 3, p. 353. Mr. Edwards gives food as Rubus, Bull. 35, U. S. National Museum, p. 67.

43. *Sericaria mori* L.

The domesticated silk worm. The food plants given by Edwards (loc. cit.) are "Osage Orange, Rubus, etc., (Morris)." The only reference I can find to Rubus as a food plant is in Jaeger (poor authority) Life N. A. Insects, p. 146, where it is stated that the worm will live for a time on the leaves of raspberry.

44. *Thyatira scripta* Gosse.

Dr. Roland Thaxter, Papilio, 3, p. 10, describes the egg and larva of this species and gives Rubus as food plant.

45. *Loxotænia musculana* Hub.

Prof. C. H. Fernald, Trans. Am. Ent. Soc., X, p. 13, gives Rubus as one of the food plants of this species, in Europe. It occurs in America in Oregon.

46 *Prodenia lineatella* Harvey.

This is a Noctuid, and the larva is allied to the cut-worms. I can find no record of its having been observed depredating on any of the Rubus, in fields or garden. Prof. G. H. French, Can. Ent., 13, p. 24, states that a larva, found in his garden, on salsify, fed readily in confinement on raspberry and peach. I have observed the larvæ seriously injuring young corn and cabbage in Tensas Parish, Louisiana, and potato vines in Arkansas, also noticed them feeding on salsify, wheat and corn, in Indiana.

Stem Gall Midge of the Blackberry.

47 *Cecidomyia* sp.?

(Ord Diptera Fam. Cecidomyidæ)

In the vicinity of New Providence, Indiana, I have collected galls on the canes of *Rubus hispidus*, or some closely allied species. Dr. Riley informs me that they are caused by an undescribed species of *Cecidomyia*,

[60] Loc. cit., pp. 162-163.

and that he collected the same thing in 1876 In the case of my own observations, though growing among other species of Rubus, the insect had confined its attention to this particular species, as none others were affected, even when growing interjacent.

The Blackberry Midge,

48 *Lasioptera farinosa* O S

(Ord Diptera Fam Cecidomyidæ)

Under the designation *Cecidomyia farinosa* n. sp., Osten Sacken briefly describes a gall as follows: "Rounded woody swelling at the base of the leaflets or on the midrib of the common blackberry; contains red larvæ."[61] We have characterized the species in conformity with that given by Prof. John B Smith, who reared his specimens from "little oval galls, (Fig. 14,) which are often united into an irregular mass," and which affect the young canes of the cultivated blackberry, near the tips.[62]

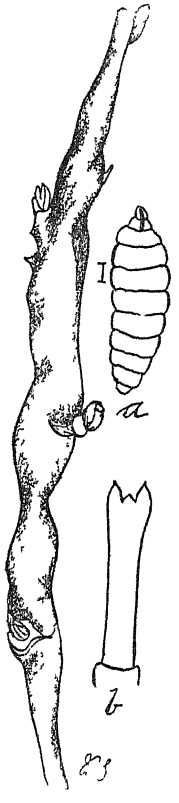

Fig 14. Blackberry Midge Galls, natural size, *a* larva enlarged, *b* breast-bone of larva more highly magnified After Smith

We are loth to believe that Baron Osten Sacken would mistake a *Lasioptera* for a *Cecidomyia*, but, still, such *might* have been the case. Immediately following his characterization of *C. farinosa* he quotes Fitch's statement in regard to *C. agrostis* n. sp., "which infests *Agrostis lateriflora*, ? numbers dwelling together in an imbricated gall, somewhat resembling the fertile aments of the hop, though larger and connected with the main stock by a short pedicel which is inserted into one of the lowest joints of the culm," and calls attention to *C. graminicula*, discovered by Kaltenbach, (Winnertz, l. c. p. 292) having precisely similar habits, forms an apparent anomalous gall likewise on a herbaceous plant, *Poa nemnralis*." From a gall precisely similar, to all outward appearance at least, formed on *Muhlenbergia mexicana*, occurring in Central Ohio and Indiana, I have reared a species of *Lasioptera* in great numbers. A figure and description of this gall, and a list of insects reared therefrom, will be found in Canadian Entomologist, Vol. 24, p. 243.

Prof. Smith further state (loc. cit.) that

"It is likely that there is a summer brood of these midges living in some other part of the plant. This is indicated by the long period between their appearance as imagos and their re-appearance as larvæ, and also, by the fact that Dr Riley has bred what seems to be this same species from a leaf gall on blackberry, but not from stem galls."

Galls which I refer, provisionally, to this species occur quite abundantly in a tract of low woods near Wooster, Ohio. These galls are of a more or less

[61] Monograph of the Diptera of N A, Loew and Osten Sacken, Pt 1, p 204

[62] Bull. N. J. Expt. Sta, N p 14, Nov 30, 1891

globular form, leathery, brown, rough with irregular shallow cracks forming an irregular net-work of depressed lines, giving the outer surface somewhat the appearance of scab on potatoes. They are situated on the midribs, on the under side of the leaflets, more often near the base, but frequently on the interior, usually not covering the upper side or encircling the rib. Sometimes two or three will be strung like beads along one rib near center of leaflet. I have not yet reared adults, and cannot say what the inhabitants will prove to be. According to Mr. L. O. Howard, a minute, black, Hymenopter *Polygnotus rubi* Ashmead, and a larger, bright green insect, a species of *Torymus*, are parasites on this gall-maker.

The Raspberry-Cane Maggot.

49. *Anthomyia*?

(Ord Diptera Fam Muscidæ)

According to Mr. James Fletcher, in Canada, there is another pest which affects the young wood of raspberries. This is the maggot of a small, black fly which lays a single egg in the axil of one of the upper leaves. The young maggot bores down the stem until full grown, and then changes to a brown puparium inside the stem.

Remedy—After a time the young cane turns black at the tip and must be cut down as soon as seen. This is a more injurious pest than *Oberea bimaculata*, where it occurs, because it burrows further down the stem before the indications of its presence are visible [63]

The 15-Spotted Lady Beetle.

49*a*. *Mysia* (*Coccinella*) *15-punctata* Oliv.

(Ord Coleoptera Fam Coccinellidæ)

Although generally considered a very useful insect, and known to be largely of carniverous food habits, yet Dr. William LeBaron, the Second State Entomologist of Illinois, states that he has seen this beetle with its head deeply immersed in a ripe raspberry, implying that they sometimes feed upon the juices of ripe and succulent fruits. [64]

The American Raspberry Beetle.

50 *Byturus unicolor* Say

(Ord Coleoptera Fam Dermestidæ)

The adult beetle was described in 1823, from specimens brought from Arkansas by Mr. Nuttal. [65] In his 14th report (1870) published in 1872, Dr. Fitch gives the following information in regard to the species:

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[63] Bull, 11, Central Expt. Farm, Dept. Agr., Can., May, 1891, p. 24.

[64] LeBaron's Fourth Rep. State Ent Ill., p. 183.

[65] Jour Acad. Nat Sci. Phila., Vol. 3, p 197

Throughout our country there occurs on the fruit of the red raspberry a small, white worm, which commonly remains adhering to the berry when it is gathered, lying usually on the inner side of the cup or cavity in the berry. Hereby the fruit is rendered unfit for the table or for preserving, until it has been looked over with the utmost care, and the berries closely examined one by one, each berry on which one of these worms is found being either thrown away or the worm removed from it. This picking over of the berries to cleanse them from these worms is a most irksome task, in which many hours of valuable time are every year spent in most of the households in our country. And notwithstanding this scrutiny, some of the worms no doubt remain, and are unconsciously eaten with the berries, it being impossible for the most piercing sight to detect them in every instance, especially those which are young and minute.

When examined with a magnifying glass, these worms are found to be plump and cylindrical, slightly tapered at each end, and nearly one-fourth of an inch in length when fully grown. They are white, each segment having on the back a broad, pale, tawny yellow band occupying more than half its surface, and being also furnished with a few short, erect whitish hairs. The mouth is darker tawny yellow. On the breast are three pairs of legs, but none on the body back of these, except at the tip, which is prolonged into a single proleg of a short, conic form, and blunt at its end; and on the apex of the last segment, above the base of the proleg, are two minute projecting points, appearing like two deep red dots.

When the worm is fully grown, it drops to the ground, probably with the fall of the berry in most instances, and secreting itself under any dead leaves or other rubbish which it there finds, it forms a cell in the dirt, in which it changes to a hairy pupa of a pale dull yellowish color, and in this situation remains at rest through the winter, till the middle of May or a little later, when it changes to its perfect form, and is then a small beetle about twice as long as thick, varying in its length from 0.12 to 0.15[66] (inch).

In a pamphlet "Injurious Insects, new and little known," issued by Dr. A. S. Packard, March, 1870, p. 12, the author refers to and figures the adult as a raspberry insect and says:

Mr. J. L. Russell, of Salem, has called my attention to its ravages on the leaves, buds and flowers of the raspberry, having been abundant for three or four summers past. It eats long strips in the leaves, but does the most injury to the fruit-buds. It was common June 18, when the sexes coupled. Hand picking proved to be the best remedy against its attacks.

Probably the same species was reported by Prof. C. P. Gillett, in Michigan in 1885.[67]

An allied species, *B. tomentosus*, has long been known as destructive to the raspberry in England. It is mentioned by Kirby and Spence as sometimes proving fatal to a whole crop by eating the blossoms. More recently, it has been treated by Miss Ormerod in her fifteenth annual report, pp. 85-89, 1892. The remedy there given is shaking the bushes over bags soaked in paraffine oil.

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[66] Trans. N. Y. State Agr'l Society, Vol. 30, p. 358. 1872.

[67] Rural New Yorker, Aug. 22, 1885.

51. *Carpophilus brachypterus* Say.

(Ord. COLEOPTERA: Fam. NITIDULIDÆ.)

This is a very small, flat, brown beetle, which I have observed quite numerous in the fruit of the raspberry, especially when this is slightly over ripe. Their small size and obscure color enables them to secrete themselves in or about the receptacle, which prevents their being observed without examining the fruit closely. The members of the genus *Carpophilus* are usually found in flowers or in fruits. I have *C. hemipterus* Linn. taken from imported figs.

52. *Limonius auripilis* Say.

(Ord. COLEOPTERA: Fam. ELATERIDÆ.)

This is one of the elaters, or snapping beetles as they are more familiarly known, and was observed by me in Indiana, feeding upon the ripe fruit of the raspberry, in July. [68]

THE RASPBERRY GOUTY-GALL BEETLE.

53. *Agrilus ruficollis* Fab.

(Ord. COLEOPTERA: Fam. BUPRESTIDÆ.)

The beetle (Fig. 15) was described from "America" in 1787, but seems not to have attracted attention as an injurious species until 1846, when an illustrated notice of the destructive work of the larvæ, in canes of Antwerp raspberry, was published by Mr. S. S. Halderman.[69] Nothing of consequence occurs in our literature on the species again until 1870, when an illustrated article in the American Entomologist, Vol. 2, p. 103, evidently from the pen of Mr. B. D. Walsh, though published after his death, gives a full life history of the pest. From this notice is taken the following:

"In the spring of the year, when raspberry and blackberry patches are being overhauled and pruned, many of the canes will often be noticed to swell out in particular places, (like a limb infested by the gout,) for the length of an inch or so, as shown in Fig. 16. Instead of being smooth and of a uniform color, like the healthy parts, the swelled part of the cane, which is a true gall, always splits up longitudinally into a great many short, rough, brownish slits, and on inspecting these gouty galls more carefully, numerous little ridges will be observed, the general direction of which is round and round the axis of the cane. If the observer takes his knife and cuts into the ridges just now described, he will find under each of them the passage-way of a minute borer, filled with the brown excrement which he has left behind him; and either in these passage-ways or in the pith of the cane he will often detect the in-

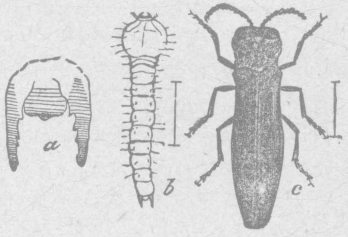

Fig. 15. *Agrilus ruficollis* Fab. *c* adult; *b* larva; *a* horns at end of larva magnified. After Riley.

[68] Insect Life, Vol. 2, p. 258.

[69] Quarterly Jour. Sci. Agr., 4, p. 300.

sidious little borer himself. This borer is a small, thread-like larva, of a creamy white color, with the front part of its body much flattened out horizontally, as in the common round-headed borer of the apple-tree, the head being small and retractile, with the jaws of a brown color, and the tail being furnished with two long, slender, blunt-pointed, dark brown thorns or horns. When full-grown it ranges in size from one-half to three-quarters of an inch. Like most other borers, this one in the earlier stages of his larval life burrows exclusively in the sapwood, thereby very generally—owing to the spiral course which he adopts—girdling and killing the cane that he inhabits. The same cane often contains several of them; and in that event the shape of the gall which they produce often becomes very irregular. Towards the end of April in South Illinois, but probably rather later in more northerly latitudes, the larva penetrates into the pith, so as to be more secure from his insect foes, and there transforms into the pupa state; and early in the summer, and sometimes even as late as the fore part of July, the perfect beetle emerges to the light of day. Although we do not know, by direct observations, at what particular time in the preceding year the raspberry gouty-galls originate, yet as the beetle comes out in June and July, we may infer by analogy that the sexes then immediately couple, and that the female shortly afterwards deposits her eggs in or on the young canes, whence in the course of the same summer there must necessarily hatch out the tiny young larvæ that are the architects of these galls."

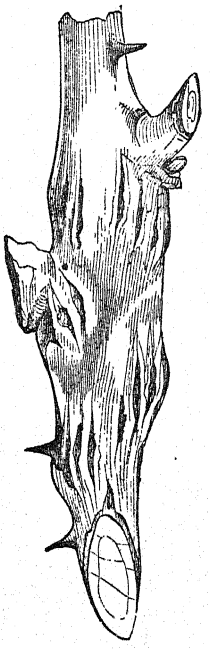

Fig. 16. Raspberry Gouty-Gall. After Riley.

To this Prof. John B. Smith has added the following observations on the early habits of the larvæ:

"By the middle of April the larva is full grown, and forms in the pith a smooth, oval cell, in which, between April 20th and May 1st, it changes to a white pupa, showing quite obviously all the parts of the future beetle. This pupa very gradually darkens and assumes more and more the shape of the perfect insect. By the middle of May no more larvæ were found and some of the beetles were already well developed, making no effort, however, at that time to bore out through the stem. On May 26th, at Hammonton, (N. J.) I found the first beetles on the leaves, eating little round holes through the entire tissue. At this date there were yet many pupæ in the stems; but more had developed into beetles, fully colored and ready to emerge. During the early part of June the beetles were more abundant, decreasing toward the end of the month. Isolated specimens were found, however, up to July 15th, giving a period of nearly two months during which the beetles are to be found in the field.

"Necessary work in other parts of the state prevented observation of the egg-laying habits of the insects; but on July 15th, before yet the last stragglers had disappeared, I found a great number of very young larvæ from one-eighth to one-quarter of an inch in length, and so slender as to be scarcely visible. The youngest of these could not have been more than two or three days old, while the oldest could

not count more than a week. In all cases the young larva had started from the base of a leaf stalk, and was working around the stem in a long spiral, eating in the sap-wood. See Fig. 17. It is safe to say that the eggs are laid at the base of a leaf stalk, generally near to the ground. On some early shoots I found as many as four different points of oviposition. The beetle probably does not lay more than one egg at the same point, and one larva at a leaf stock is the rule; but sometimes different specimens may choose the same point for oviposition, and, in the one case three larvæ had started together, burrowing under the bark, each for himself, in distinct channels. There seems to be no rule as to the direction in which the girdling is done, some starting to the right and some to the left. At this date no trace of swellings could be noted, and it was impossible to locate larvæ from the outside. Sometimes, when eggs are laid at the base of a leaf from which a vigorous lateral starts, the young larva will run up the lateral rather than the main stem. Early laterals are sometimes as badly infested as main shoots."

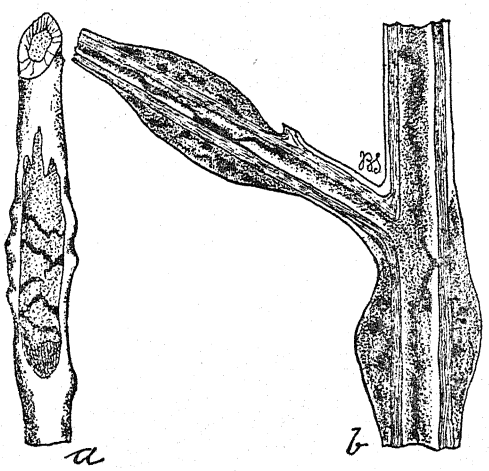

Fig. 17. *a*, showing track of larva, bark and pith of main cane and lateral; *b*, track of young larva. After Smith.

The species is quite abundant in Northern Ohio, and I have observed the sexes pairing and feeding on the leaves late in July. They appear to be especially abundant on the bushes which grow abundantly along fences and roadsides. It would seem to me that one of the best protections from future attacks would be to keep these wild plants cut off, thereby confining the insect to the woods instead of along cultivated fields.

Mr. A. D. Hopkins, of the Experiment Station of West Virginia, has reared two parasites from the larvæ, viz., *Charitopus magnificus* and an undescribed species of Bracon.[70]

The Rose Chafer.

54. *Macrodactylus subspinosus* Fabr.

(Ord. Coleoptera: Fam. Scarabæidæ.)

While the raspberry and blackberry are not especial subjects of the attacks of this insect, yet its extremely destructive habits among other fruits, render a notice of it in its various stages almost a necessity, particularly as not every one is familiar with its developments. I therefore extract from a paper by C. V. Riley the following statements:[71]

[70] Bull. 15, W. Va. Ag. Exp. Sta., March, 1891.

[71] Insect Life, Vol. 2, pp. 295-302, 1890.

"A native North American insect, there is every reason to believe that this Rose chafer, or Rose bug, (Fig. 18) as it is more generally called, has increased in number with the progress of horticulture, for the perfect beetle evidently shows a preference for the blossoms and sweeter and more tender fruit of our cultivated plants as compared with those of wild plants. Another reason may be found in the increased area of pasture and meadow lands which form the natural breeding grounds of the species. The first published account of this insect seems to be that given by Dr. Harris in his "Minutes toward a history of some American species of Melolonthæ particularly injurious to vegetation" (Mass. Agric. Report and Journal, X, 1827, pp. 1-12,) reported in N. E. Farmer, 1827, (Vol. 6, p. 18 ff.) In this account Dr. Harris says that at the time the bugs were first noticed they were confined to the roses, but within forty years they had prodigiously increased in number and had become very injurious to various plants. From this it would appear that as far back as the last century the insect was known as injurious.

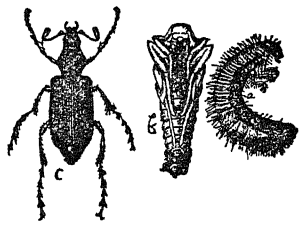

Fig 18. The Rose Chafer. Adult, pupa, and larva After Riley.

Natural History.

"According to Harris the female beetle lays her eggs to the number of about thirty, about the middle of July, at a depth of from one to two inches beneath the surface of the ground. He does not state the favorite place for oviposition, but in our experience the larvæ are especially abundant in low, open meadow land or in cultivated fields, particularly where the soil is light and sandy. Harris states that the eggs hatch in about twenty days, and, while the period will vary with the temperature, the larva is found fully grown during the autumn months. With the approach of cold weather it works deeper into the ground, but in the spring will frequently be found near the surface or under stones and similar objects, where it forms a sort of cell in which to pupate. In confinement the pupa state has lasted from two to four weeks. The perfect beetle issues in the New England States about the second week of June, while in the latitude of Washington it is seen about two weeks earlier. It appears suddenly in great numbers, as has often been observed and commented upon, but this is in conformity with the habits of other Lamellicorn beetles, *e. g.*, our common May-beetles (Lachnosterna,) and this habit is still more marked in certain species of Hoplia and Serica. It remains active a little over a month, and then soon disappears. The species produces, therefore, but one annual generation, the time of the appearing of the beetle in greater abundance being coincident with the flowering of the grape-vine.

Geographical Distribution.

"The species is recorded by Dr. Horn (Trans. Amer. Ent. Soc., 1876) as occurring from Virginia to Colorado and northward. It is thus not represented in the extreme south and west of the Rocky Mountains. Northward it extends into Maine, and Canada, and Minnesota. It is certainly absent, or at least very scarce in western Kansas, though common and destructive in the eastern and more wooded portions of the State."

Food Plants and Ravages.

The food of the larva consists of the roots of grasses and probably also of other low plants. Whether it also feeds on the rootlets of trees and shrubs has not

been definitely ascertained, although the larvæ have been found quite numerously around the bases of oak trees near Washington, both by Mr. Koebele and Mr. Schwarz. We found them quite numerous in the sandy lowlands of the Merrimac Valley, New Hampshire, on cultivated ground, where they must have fed on the roots of various weeds or on those of meadow grass and cultivated rye and maize. It is probable, however, that they occur yet more numerously in unplowed pasture and meadow land than in cultivated fields.

"One peculiarity in the food habits of the larva still remains to be mentioned here, viz; that referred to in our report as U.S. Entomologist for the year 1883 (p. 174): While searching for locust eggs in the infested fields at Boscawen, N. H., we repeatedly found the larva of this Macrodactylus feeding on the egg-pods of *Caloptenus atlanis*. This is certainly a remarkable and exceptional food habit in a plant-feeding larva, but it is paralleled in the common white grub (larva of *Lachnosterna fusca*) which we have shown in the first report of the U. S. Entomological Commission (p. 305) to have a similar habit. The habit is doubtless developed only when the locust eggs are thickly laid in the ground.

"The beetle has a partiality for flowers, but also feeds upon leaves of various trees and bushes and attacks certain fruits. It has a predilection for the flowers of roses, wild as well as cultivated,* and in the experience of many observers, prefers white roses to red ones. Another favorite food is the blossom of the grape-vine, with a decided preference for that of the Clinton. This last fact was first pointed out by Walsh in his first report on the Insects of Illinois (p. 24), and has been enfirmed by many other observers and by our own observations Dr. Lintner, in his first New York Entomological Report (p. 229), contradicts this experience, which only goes to show how the habits of the same species will differ in different sections of the country. Flowers of raspberries and blackberries do not escape its ravages. Mr. E. H. Miller states in the American Agriculturist (see Amer. Nat., v. 17, 1883, p 1291), that the flowers of *Deutzia scabra* are even preferred by the beetle to the grape-vine. The blossoms of the various species of spiræa are often crowded with the beetles and the same may be said of the blossoms of sumach, the common ox-eye daisy, *Magnolia glauca*, mock orange, and some other plants This list could be greatly extended, but we close it with the statement that the beetles also devour the blossoms of *Pyrethrum cinerariæfolium*.

"The foliage of most, if not all, of our cultivated fruit trees and especially Apple, Pear, Peach, Cherry, and Plum at times suffer greatly, the two last-named trees being apparently more attractive than the others. The foliage of cultivated grape-vines is almost as eagerly devoured as the blossoms, and the leaves of oak, alder, and other forest trees also serve as food. Of low-growing plants the beetles cut the leaves of strawberries, rhubarb, and of nearly all garden vegetables, as also of sweet potato, corn, wheat, grass, and many wild plants.

"Not satisfied with this amount of damage, the beetles attack the fruit of peaches, cherries, apples, and grapes when just forming.

"Among ornamental plants the rose is the greatest sufferer. Harris states that the beetle was first noticed on the rose (hence its popular name), and that it afterward acquired the habit of feeding on grape-vines and fruit trees.

REMEDIES.

'It has been assumed by most writers that we cannot successfully attack the Rose Chafer in any of its earlier states. To search for the eggs in the ground would be impracticable. It does not, however, follow because of the poor success that has generally resulted from attempts to destroy similar larvæ that they cannot be successfully destroyed. In the case of the common European Cock-chafer (larva of *Melolontha vulgaris* and *hippocastani*) and of our own White Grub (*Lachnosterna*

*The Cinnamon rose, *Rosa cinnamonica*, is said to enjoy immunity

fusca) the methods adopted have consisted in plowing and hand-picking. The experiments made, however, on a similar larva with the kerosene-soap emulsion clearly show that we have in this insecticide a means of successfully destroying the bulk of the larvæ of the Rose Bug wherever they are known to be sufficiently abundant to justify such treatment. A thorough investigation should be made in the direction of ascertaining the preferred breeding grounds of the species, and it were rash to say here that we have no effectual mode of preventing the insect, notwithstanding the disfavor in which this mode of warfare has been held in the past.

"It is evident, however, that for the present we should concentrate our efforts on the destruction of the beetles especially when they first issue from the ground and congregate in the garden on our roses, grape-vines and fruit trees. A brief statement of the various methods that may be employed for this purpose may prove advantageous. Hand-picking and killing the beetles either by crushing them or throwing them into hot water, or water having a scum of kerosene upon it, has proved useful and satisfactory in a limited way, as also the shaking and knocking down of the beetles into pans or upon sheets saturated or smeared with coal oil. These measures are best carried out and most satisfactorily in the early morning hours and toward evening, as the beetles are then more sluggish and not so quick to take wing as they are during the heat of the day. White roses, Spiraes, or Deutzias, planted on a place, will attract great numbers of the beetles, and thus not only facilitate the destruction of these last, but act as a kind of protection to other plants.

"As to other topical applications intended to destroy the beetles, whether directly or by poison taken with the food, the experience with the arsenites is that they are of little avail, and the experience with other materials, like hellebore and pyrethrum, has been so conflicting, that we cannot consider either of them reliable or satisfactory. Pyrethrum would seem to have given on the whole the most satisfactory results, and the experience of Dr. E. S. Carman, editor of the Rural New Yorker, would certainly show that it may be used advantageously.

"The trouble with all these remedies is that the beetles during their brief season continue to issue from the ground and to congregate upon their favored plants in such numbers, under favorable circumstances, that however fatal an application may be it has to be continued, and the most persistent may justly become discouraged in a fight with these beetles when they are abnormally abundant and swarm to the extent we have known them.

"As early as 1829 Dr. R. Green, as quoted by Harris, urged as a preventive measure the covering of the grape-vines with millinet, but, however valuable such a method may be for choice vines in limited numbers, it would evidently be too costly for large vineyards or for larger fruit trees.

"Another protective measure (first suggested in the Rural New Yorker, May 19, 1883,) is to dust the plants with air-slaked lime or gypsum, and Prof. C. M. Weed has suggested as an improvement upon it (7th Ann. Rept. Ohio Agr. Exp. St., 1888, p. 151,) a liberal spraying of lime water, from one-half to one peck of lime to a barrel of water. Mr. E. A. Dunbar, of Ashtabula, Ohio, who tried this "whitewashing" of his grape-vines and peach trees, reports most satisfactory results."

Apropos to the above, and in conclusion, I would like to introduce the following letter from Mr. Dunbar, which clearly defines the situation in Ohio:

ASHTABULA, *July 31, 1892*

F. M. WEBSTER, *Wooster, Ohio.*

DEAR SIR:—Some time ago I applied to you for help to exterminate the Rose bug, and you replied to try hot water.

I did not try it, and had you known the facts of the case I feel sure you would not have advised its trial, namely: Five acres grapes, ten acres apple, three acres

peach, on part of which the bugs were so thick they fairly covered fruit and leaves, and were all through the air like a swarm of bees. We tried hand-picking, but a person might as well stay by one vine all the time as to go to another and let the first be eaten by fresh bugs.

Now, my idea is that we must apply something, the presence of which will drive away the bugs. You see it is impossible to save the fruit by destroying bugs (even if one could destroy them) for fresh bugs at once take the place of others, and destroy fruit before you can return to get them, but if we could spray on some mixture that they don't like and won't come near, then we've solved the problem; and when found it will be some simple thing that we ought to have known long ago.

I do hope before they come again you will be able to direct me how to deal with them, for the result of their work brings the balance of my profit and loss account on the wrong side

Hoping to hear from you further, I remain,

Yours truly,

ERNEST DUNBAR.

55a. *Anomala binotata* Gyll.

(Ord. COLEOPTERA. Fam. SCARABÆIDÆ).

I have several times observed these beetles feeding on the blossoms of blackberry, sometimes in considerable numbers. On one occasion a large fly, *Laphria tergissa*, was observed to capture and fly away with one of these beetles in its grasp. The species is seldom abundant and is not likely to become destructive.

THE GOLDSMITH BEETLE.

55. *Cotalpa lanigera* Linn.

(Ord. COLEOPTERA Fam. SCARABÆIDÆ)

This beetle, Fig. 19, is described as being nearly an inch in length, bright yellow above, with a golden metallic luster on the head and thorax, while the under side of the body is copper-colored, and densely covered with white hairs.

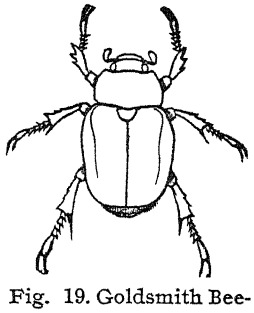

Fig. 19. Goldsmith Beetle. Adult, natural size.

Dr. Harris says that it is very common, remarking that it begins to appear in Massachusetts about the middle of May, and continues generally till the 20th of June. "In the morning and evening twilight they come forth from their retreats, and fly about with a humming and rustling sound among the branches of trees, the tender leaves of which they devour. Pear trees are particularly subject to their attacks, but the elm, hickory, poplar, oak, and probably also other kinds of trees, are frequented and injured by them." Dr. Lockwood has found it on the white poplar of Europe, the sweet-gum, and has seen it eating the Lawton blackberry. He adds that the larvæ of these insects are not known; probably they live in the ground upon the roots of plants.

It has remained for the Rev. Dr. Lockwood to discover that the grub or larva, Fig. 20, of this pretty beetle in New Jersey devastates strawberry

beds, the larva feeding upon the roots, in the same manner as the May beetle. His account was first published in the American Naturalist (Vol. II, pp. 186, 441.) He says that in the month of May in the ordinary culture of his garden the spade has turned up this beetle generally in company with the May beetle. He found that some of the larvæ, as in the case of the May beetle, assume the adult beetle state in October and remain under ground for seven months before appearing in the spring.

Fig. 20. Larva of Goldsmith beetle.

I have some times taken this insect quite abundantly about electric lights in May and June.

The Giant Root Borer.

56. *Prionus laticollis* Drury.

(Ord. Coleoptera: Fam. Cerambycidæ.)

Although this insect occurs in Ohio, it is placed in the list of blackberry insects on the statements of Prof. John B. Smith, of the New Jersey

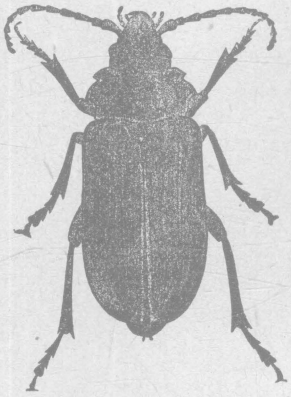

Fig. 21. Giant Root borer Adult. After Riley.

Fig. 23. Giant Root borer; pupa. After Riley.

Experiment Station, who says of the larva: "It lives in the large, woody portions of the main root, in which it bores huge channels, and the sudden dying off of several canes in a hill, is a certain indication of its presence.[72]"

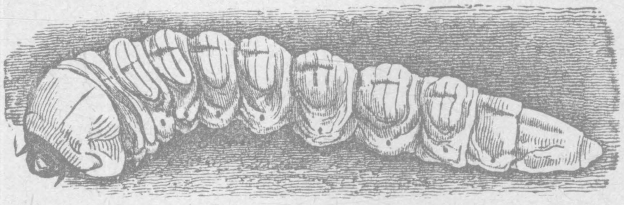

Fig. 22. The Giant Root borer; natural full grown size. After Riley.

[72] Bull. N., N. J. Agr'l Exp. Sta., p. 12, Nov. 30, 1891.

The insect is known to destroy the roots of grapes and of apple and other fruit trees, and also the poplar, Balm of Gilead, and black oak.

THE RASPBERRY AND BLACKBERRY CANE-BORER.

57. Oberea bimaculata Oliv

(Ord. COLEOPTERA. Fam. CERAMBYCIDÆ.)

In its destructive stage this insect is a footless grub not unlike the Round-headed Apple-tree Borer. The adult, Fig. 24, is a slender black beetle, with yellow thorax and very long antennæ, or horns. Its injuries to blackberry and raspberry together with a brief account of its life history are given by Harris in his Insects Inj. Veg. Ed., 1841, p. 91. I have not observed any serious injury from this insect in Ohio, and have only received it once, when injured canes were sent me from Kelley's Island. A very good account of the insect and its injury was given by Mr. Saunders in 1873[73], but a much later paper by Messrs. Comstock and Slingerland will give a better idea of its injuries, and it is quoted here in full[74].

Fig. 24. *Oberea bimaculata* Adult. Natural size.

"In the latter part of July, two years ago, Professor Caldwell drew my attention to an extensive destruction of blackberry canes, at his summer residence, near Kidders, on the shore of Cayuga Lake. At that time the leaves on many of the bearing canes were observed to be dying, and the fruit, which was not yet mature, to cease its growth. An examination of the diseased canes revealed the presence in each of a boring grub, the cause of the injury.

"At the time of this observation five per cent. of the canes were found to be destroyed by this borer, and as the infested canes were only just beginning to die, some of them were not detected at that time; thus the injury was even greater than five per cent. of the crop. Although the infested canes produce fruit, it does not ripen, as the canes die before it matures.

"The boring larvæ were found only in the bearing canes. They are cylindrical, footless, yellowish grubs, measuring about three-fifths of an inch in length. When first observed in the latter part of July they had made in each case a burrow less than two inches in length; but after that date the burrows were rapidly extended downward so that they became in many cases two feet or more in length and reached the base of the canes. The burrows are about one-eighth of an inch in diameter, they wind from side to side of the pith, and at frequent intervals penetrate the woody part of the cane. In some of the cases where the woody part of the cane is penetrated an opening is made through the bark. These openings occur at intervals of a few inches throughout the length of the tunnelled portion of the cane; they are small, being about one-third of the diameter of the burrow; and their object is to enable the larva to deposit its excrement outside of the burrow. It is evident that the larva puts the caudal end of the body at this opening and forces the excrement directly into the open air, for it was found in long strings, some of them a half inch in length, on the sand below the openings; and the burrows were always free from it.

"An examination of some of the canes in our breeding cages made in the last half of September showed that the borers were still in the larval state. But they

[73]Rep. Ent. Soc., Ontario, 1873, p. 9.

[74]Bull. 23 Agr'l. Exp. Sta., Cornell Univ., pp. 122–4, 1890.

had penetrated the canes to the bottom where the cut ends were inserted in the sand of the cages. From this I inferred that normally the grubs work their way into the root of the cane before transforming, and that they reach the root early in the autumn. Later when the species was determined I found that the fact of its wintering in the roots of the infested plants had been recorded.

"The insect remains in the roots till the following summer when it emerges as a long-horned, slender-bodied beetle about a half inch in length. It is of a deep black color except the segment next the head, the prothorax, which is yellow. There are usually two or three black spots on the upper part of this segment, but frequently these are wanting.

"Although I can find no account of this insect infesting blackberry canes to the extent which we observed, it has long been known as a pest in raspberry plantations; and its peculiar method of oviposition has frequently attracted attention.

"The eggs are laid in the early summer, usually during the month of June. They were not observed in the blackberry; but when the insect infests raspberries the first indication of the injury noticed is usually the withering and drooping of the ends of the young shoots. If these be examined there will be found at the base of the wilted portion two rows of punctures encircling the cane about half an inch apart, and between them a small hole in which an egg has been deposited. This double girdling of the cane is done by the beetle with her jaws at the time she lays her egg. It has been suggested that the purpose served by this girdling is the arresting of the circulation of the sap in this part of the cane; and in this way the prevention of the crushing of the tender egg by a vigorous and rapid growth of the tip of the cane.

"The methods of combating this insect are simple, but they require prompt attention. As soon as the tips of the canes begin to droop they should be cut off below the point where they are girdled. In this way the larva can be destroyed before it has begun to bore into the lower portion of the cane, and thus only the tip of the cane will be lost. When, however, the first indication of the presence of this pest is the dying of the entire cane caused by the boring of the larva, as was the case in our experience narrated above, the infested canes should be promptly cut out and burned. These canes can be readily recognized by the dying of the leaves and by the small holes in them described above. They are most likely to be observed at the time of the blackberry harvest. It is of the utmost importance that the cutting and burning of these canes should be done promptly. For if it be delayed till autumn, the larvæ will have penetrated the roots and will then be beyond the reach of the pruning shears. As illustrating the practicability of this method of combating this pest, I will state that, doubtless owing to the thoroughness with which we removed the infested canes from Dr. Caldwell's place, two years ago, not a single infested cane could be found last year or this."

58. *Chlamys plicata* Fabr.

(Ord. COLEOPTERA Fam. CHRYSOMELIDÆ)

The adult is a small beetle which, examined under a glass, is very beautiful, yet when seen by the unaided eye on the leaves of plants has a very deceptive resemblance to the excreta of caterpillars, affording thereby an interesting case of protective mimicry. The earliest reference to its life history and food is by Dr. C. V. Riley, and is as follows:—

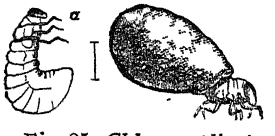

Fig. 25. *Chlamys plicata.* *a.* larva. *b.* same in case. After Riley.

I have frequently reared *Chlamys plicata*, Oliv., from the larva, Fig. 25 *a*, which may be found feeding on oak, sycamore and blackberry. The beetles are found in

early spring, and the eggs, which Miss Murtfeldt first succeeded in obtaining, are perfectly oval and of a highly polished Venetian-red, and look like little pieces of coral. They are taken between the hind tarsi and treated to a covering of dark, sticky excrementitious matter, very much in the same way as in *Coscinoptera*. The covering is, however, of simple and uniform surface. It is somewhat bell-shaped, the upper end being largest, squarely docked, and slightly depressed so as to form a circular rim around the margin. The small end is anchored to the down of the leaf by a few gummy shreds. If the female is disturbed while covering the egg, she sticks it in the ventral cavity and runs away. It would appear from Miss Murtfeldt's observations that while uncovered this egg is greedily sought by the males, which devour it; but that when once covered they never touch it. How essential to the species is a little bit of dung, in the light of this observation! The young larva, as in *Coscinoptera*, cuts its way out at the attached end, and makes a house of the egg-case, gradually adding to it, with age. This apical egg-case may always be distinguished by its darker color, and finer and more glutinous material, from the rest of the larval house, which is more or less covered with the leaf-down of its food plant, and is, in consequence, on the sycamore, quite grayish and pilose, Fig. 25, *b*. It eats irregular holes in the leaves, and when about to transform, securely fastens the case to the same. The pupa is of a brilliant flesh color, and characterized chiefly by having at the end of the body two, short, blunt, dorsal tubercles directed upward and outward, and two terminal processes in a line with body, more proximate and pointed. The beetles issue through a lid, smoothly cut from the pointed free end of the case, and they feed on the same plants by skeletonizing the leaves.[75]"

Dr. Packard, in his Guide, p. 510, figures and describes the larva which as stated by Riley is a case bearer.

To the food plants given by Riley are added, hazel (Beutenmuller,) white birch and sweet fern (Packard.)

59 *Bassareus mammifer* Newm.

(Ord COLEOPTERA: Fam CHRYSOMELLIDÆ)

A small black beetle with a red spot on each shoulder and another at tip of wing covers. Observed feeding on blackberry by Mr. Beutenmuller.[76]

60 *Cryptocephalus binomis* Newm.

(Ord COLEOPTERA: Fam. CHRYSOMELIDÆ)

Taken on blackberry in Florida by Mr. Beutenmuller. (Loc. cit.)

61. *Cryptocephalus venustus* Fab.

(Ord COLEOPTERA: Fam. CHRYSOMELIDÆ.)

Small yellow beetles with brown thorax and wing covers with two oblique black stripes. Given as inhabiting blackberry by Mr. Beutenmuller. (Loc. cit.)

62. *Cryptocephalus quadruplex* Mim.

(Ord. COLEOPTERA: Fam. CHRYSOMELIDÆ.)

Small black beetles much like *C. mammifer*, but not so large. Observed by myself feeding on blackberry leaves in Ohio.

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[75] Sixth Rep. Ins. Mo., pp. 128–9.

[76] Entomologica Americana, Vol. 6, p. 175.

63 *Pachybrachys carbonarius* Hald.

(Ord. COLEOPTERA: Fam. CHRYSOMELIDÆ.)

Small, robust, black beetles observed by myself feeding on leaves of blackberry in central Ohio.

65. *Tymnes tricolor* Fab.

(Ord. COLEOPTERA: Fam. CHRYSOMELIDÆ.)

This species is allied to the one next following, and is recorded by Mr. William Beutenmuller as feeding on the blackberry.[77] It is shaped much like Paria, but is larger and without spots.

65. *Paria 4-notata* Say.

(Ord. COLEOPTERA: Fam. CHRYSOMELIDÆ.)

These are small, shining, robust beetles a little over one-eighth of an inch long, of a brown color with four black spots on the back. I have repeatedly observed them in Ohio eating holes in the leaves of blackberry and raspberry. This species is not known to be especially injurious, but others of the genus, *P. 6-guttata* Lec., of which *4-notata* is but a variety, and *P. aterrima* are known to greatly injure the strawberry by riddling the leaves with holes, and the larvæ of the latter destroy the roots. For a full account of this last species see Thirteenth Report State Entomologist of Illinois.

THE SOUTHRN CORN ROOT-WORM.

66. *Diabrotica 12-punctata* Fab.

(Ord. COLEOPTERA: Fam. CHRYSOMELIDÆ.)

This common beetle, Fig. 26, *e*, allied to the striped cucumber beetle, is too clearly portrayed in the accompanying figure to require a description. It was described in 1801[78] under the genus *Galereuca*, and the

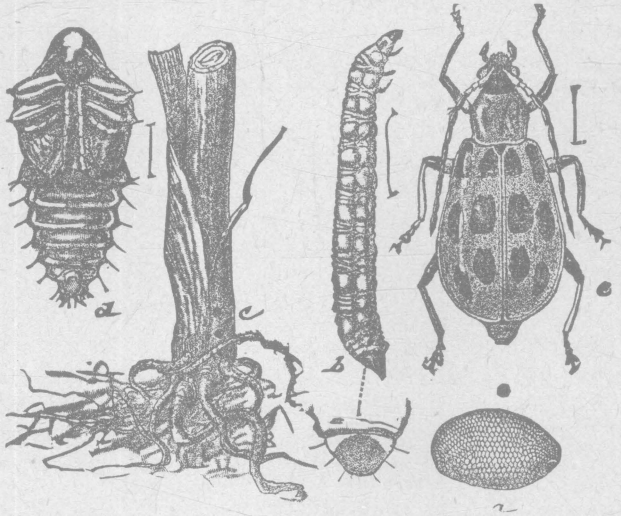

Fig. 26. *Diabrotica 12-punctata*: *a.* egg, greatly enlarged; *b.* larva; *c.* corn-stalk, showing punctures; *d.* papa; *e.* adult. After Riley & Howard.

[77] Entomologica Americana, Vol. 6, p. 176.
[78] Fab. Syst. Eleutheratorum, 1, p. 457, 1801

indications are that it early began to develop its destructive tendencies. As early as 1828, complaints came from Virginia of the depredations of "a little white worm with copper-colored head, which perforated the stalks of young corn just below the surface of the ground, destroying its growth," which agrees well with the depredations of the larvæ of this insect on that cereal. In 1854 Mr. Townend Glover speaks of it under the name of *Galereuca duodecimpunctata* as "devouring holes in the petals of the cotton plant in South Carolina,[79] where he says the planters accused them of also eating into the young bolls. The next year he again mentions the insect in this connection and also figures it.[80] In 1866, Mr. B. D. Walsh (Prac. Ent., Vol. 1, 110) stated that it injured the flowers of dahlias and the leaves of melon, cucumbers and other plants. Dr. C. V. Riley (Second Mo. Rep., p. 66) says they may be found embedded in the rind of both melons and squashes. Prof. Lugger has found the larvæ feeding on the roots of *Rudbeckia.* It appears to have been reported as injuring corn, working in the larval stage, in Alabama in 1883, Mississippi in 1884, Virginia in 1886, and Maryland in 1890.[81]

The first published notice of serious injury to corn by attacks of the larvæ, was by myself, having studied the pest in Louisiana and Arkansas in 1887,[82] and I have since found the larva eating into the stems of young corn and young wheat in October, and observed the adults feeding on growing corn, wheat, oats, cabbage, cauliflower, beans, potato, silk of corn, and the unripe kernels of both wheat and corn. In a note in Insect Life, Vol. 1, p 58, the adult is recorded as injuring the foliage of plums, apricots, cherry and Hansell raspberry. Later, Dr. Riley has recorded serious injury to the rose.

Prof. Garman, in his paper cited at length a little further on, states that the larvæ injured corn during the years 1889 and 1890 in Virginia, Alabama, Mississippi, Louisiana, Arkansas, Kentucky, Illinois, Indiana and Ohio.

Since coming to Ohio I have become aware that there is a root worm affecting the corn, over a considerable portion of the state, but I am not able to refer the injury entirely to this or any other pest of the corn field with which I am acquainted, that is known to occur over the affected portion of the state.

In Psyche for February and March, 1891, Prof. H. Garman figures the insect in all of its stages and gives a most excellent review of its previous history. He, however, criticises our description of the larva in Insect Life, Vol. 3, p. 150, and, in one case, justly. We described the larva from alcoholic, and, therefore, somewhat distorted specimens, and used the term "a pair of anal prolegs" when there is really but one, as

[79] Ag. Rep U. S. Pat. Office, 1854, p 60.
[80] Loc. cit., 1855, p. 90, Fig. 1, Pl. 8.
[81] Insect Life, Vol. 4, p. 104.
[82] Rep Comm. Agr 1887, p 148.

we would have at once suspected had we recalled the fact that the larva of *D. vittata* and *D. longicornis* each have but one anal proleg. In his figure of the adult, Prof. Garman, unfortunately, did not do himself justice, and it would be difficult to recognize the species from his figure, or say whether he intended to portray *D. 12-punctata* or some of the coloral variations of *Cerotoma carminea* Fab., another beetle which injures beans in Indiana, and beans and cow peas in the South, and also in Kansas. The two pits on the prothorax, which he is so careful to mention in his description of the adult, are not pits at all, but "deep impressions,"[83] and are not specific but generic characters, although in his drawings of *D. longicornis*, as shown in Twelfth Report of State Entomologist of Illinois, p. 15, he overlooked these depressions entirely, and, therefore, his figure does not represent that or any other species of the genus.

There are probably two broods of the insect each year, as we have observed them pairing in July and even later. It is vastly more likely to prove a pest of the farmer than of the fruit grower.

67. *Chelymorpha argus* Leich.

(Ord COLEOPTERA Fam CHRYSOMELIDÆ)

This beetle is stated by Prof. Saunders[83a] to occasionally feedupon the leaves of the raspberry. The species has been several times described, it being *cassidea* Fab; *cribraria* Fab; *17-punctatum* Say;[84] *Lewisii* Crotch.[85] Its distribution as given by its various describers is the Atlantic region, New Mexico and Arizona, Say locating it from Arkansas near the Rocky Mountains. The Experiment Station has specimens from Massachusetts, Pennsylvania, Indiana and Illinois.

Nothing appears to have been learned of its habits, and it is sometimes considered as a corn insect, from the fact of the larvæ having been sent to Prof. Lintner by Mr. C. L. Landers, Afton, Chenango county, New York, July 15, with the information that they were depredating upon corn, barley, cabbage, grass, plantain and other weeds. From these larvæ Prof. Lintner reared adults August 19th.[86] I have found the beetles quite abundant on nettle in woods in Illinois.

Adults were sent Prof. Herbert Osborn by D. H. T., Sioux City, Iowa, found upon corn.[87]

The beetles were observed feeding upon foliage of pea vines in July, and sent Dr. J. A. Lintner by Peter Henderson, New York City.[88]

68. *Rhynchites bicolor* Fab.

(Ord. COLEOPTERA · Fam RHYNCHITIDÆ.)

This is a smooth, red beetle, somewhat larger than the plum cur-

[83] Le Conte and Horn's Classification, p. 348.

[83a] Insects Inj. to Fruits, p. 315.

[84] Complete Writings, Vol. II, p. 207.

[85] Proc. Acad. Sci. Phila., Vol. 25, p. 77.

[86] Fifth Rep. St. Ent. N. Y., pp. 14, 201, 207.

[87] O. J. Farmer, Sept. 9, 1890.

[88] Lintner, 6th Rep., p. 188.

culio, but with a longer and more slender rostrum or snout which, with the legs, are jet black. It occurs, often quite abundantly, on the bloom of roses upon which it feeds, from the Atlantic to the Pacific coast. It was reported by the late James Cassidy, Botanist and Horticulurist of the Colorado Experiment Station, as feeding on the raspberry in large numbers in Colorado.

The Strawberry Weevil.

69. *Anthonomus signatus* Say.

(Ord. Coleoptera: Fam. Curculionidæ.)

Since 1871 this has been known as a strawberry pest and has injured the latter fruit in Maryland (Glover), Missouri (Riley), Michigan (Cook), and New York (Riley). The insect is a small curculio or snout beetle, Fig. 28, of a dull reddish color, and the elytra or wing covers spotted or banded with whitish. Their length, including rostrum, is about one-tenth of an inch. They attack the strawberry by eating the blossoms and puncturing the stems just below the bud, causing the latter to wither and die. They were sent the Department of Agricuiture from Canobie Lake, N. H., by Mr. George Dimmock, in June, with the statement that they were proving quite destructive to the buds of blackberries, especially the Wachusett variety.[89]

Fig. 27. Adults attacking blackberry. After Riley.

Fig. 28. Strawberry Weevil. Adult. After Riley.

The Rocky Mountain Locust.

70. *Melanoplus spretus.* Thos.

(Ord. Orthoptera: Fam. Acrididæ.)

In the west, this species is too well known to need description, and as there is no likelihood of its appearing east of the Mississippi river, I will only quote a single statement from Riley's Seventh Missouri Report, in which he says: "Of berries, strawberries and blackberries are devoured where raspberries are frequently unmolested."

Fig. 29. The Rocky Mountain Locust. After Riley.

The Meadow Katy-Did.

71. *Orchelimum glaberimum.* Bun.

(Ord. Orthoptera: Fam. Locustidæ.)

There often come to me examples of an injury to the canes of rasp-

[89] Insect Life, Vol. 4, p. 76: Loc. cit., Vol. 5, pp. 167–86. This last publication came after this article was in type.

Fig. 30.

berry, which is illustrated by the accompanying Fig. 30. Dr. C. V. Riley was, I believe, the first to call attention to this injury to the raspberry, and his statements, extracted substantially from his Seventh Missouri Report, p. 123, are as follows:

"A sixth kind of puncture is illustrated herewith, and is found in a variety of soft, fibrous plants, such as the more cylindrical parts of Indian corn, the stems of roses, and particularly those of the raspberry. There are usually ten or twelve rounded punctures, at a distance of from half an inch to an inch, or more, from each other—the fibre of the plant being torn in shreds longitudinally. Upon cutting into these punctures, the wood is found to be discolored and dead, as far as they extend, and in the center of the pith, placed longitudinally, is an elongate, dull yellow, opaque, soft, more or less flattened egg, 0 22 inch long, and 0 04 wide, the anterior end tapering to a tolerably fine point the posterior end more blunt. I have not yet succeeded in hatching the insect from these eggs, and it is impossible to say positively to what species they belong. But I strongly incline to believe that they produce our largest meadow-grasshopper, (*Orchelimum glaberimum*, Burm.,) because I have had just such eggs deposited in cork by the female of this species, kept for that purpose in confinement, and have found it quite common where these punctures were abundant. It is a glassy green species, with some brown each side of the thorax, the female having a strong, smooth, cimeter-like ovipositor, and the male a transparent violin at the base of his front wings, which is principally instrumental in causing that incessant and continued singing or ringing so characteristic of our autumns."

The Snowy Tree Cricket.

72 *Œcanthus niveus* Sen.

(Ord Orthoptera Fam Gryllidæ)

This mischievous little depredator is about seven-tenths of an inch in length, of a pale whitish-green color, and semi-transparent, with several dusky stripes on the head and thorax, the legs and antennæ are also dusky. Fig. 31.

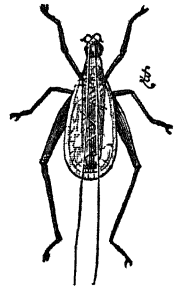

Fig. 31. Male of Snowy Tree Cricket. After Harris.

In autumn the female punctures the twigs of various trees and bushes, but more especially the canes of the raspberry and blackberry, and into each cavity thus made she places a yellowish, semi-transparent egg, about one-eighth of an inch in length, and slender. Close to this she will make another cavity and in it deposit another egg, and so on, until sometimes the series of closely placed punctures will extend for an inch or more in an irregular line on the cane. Fig. 32. This so weakens the cane that it will frequently be killed or broken off by the winds. Often, the weather will cause a split open along the line of punctures, which kills the cane. While

these eggs are pushed through the woody portion of the cane into the pith yet strangely enough the young do not feed on this any other part of the plant, but so soon as they or hatch make their way out and, so far as known, are carniverous, feeding largely on aphides or plant lice, their whole after life being, largely at least, of benefit to the fruit, vegetable and grain grower. To such an extent is this true, that it is really somewhat of a question among entomologists whether the insect does more harm than good during its life. A nurseryman in Indiana once stated to me that until he planted raspberries in his young orchard he had much trouble from aphides, but afterwards this was much less, though his raspberries were often seriously injured by the tree crickets. While such evidence is not of sufficient exactness to be of any considerable value, the observations of others, especially those of Miss Murtfeldt in Missouri, leave no doubt as to the probability of the effect being as stated. I have observed that, following a year when aphides were exceedingly plentiful, there would be an unusual number of complaints of the work of the tree cricket.

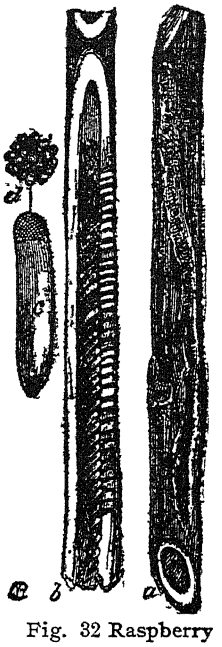

Fig. 32 Raspberry Canes affected by Tree Cricket; *a* punctured cane, *b* same split showing eggs, *c* eggs enlarged, *d* granulated end of same greatly enlarged. After Riley.

The earliest report of the ravages of the insect, in raspberries, will be found in Dr. Fitch's Twelfth Report on the Insects of New York[90], but strangely enough, in the somewhat elaborate discussion of the subject, the injury is attributed to the buffalo tree hopper, *Ceresa bubalus*.

The eggs are sometimes destroyed by small Hymenopterous parasites.

The Wheat Thrips.

73. *Thrips tritici* Fitch.

(Ord Thysanoptera: Fam. Thripidæ)

In some remarks at the Rochester meeting of the Association of Economic Entomologists, Prof. S. A. Forbes stated that "this insect attacked the flowers of the raspberry and blackberry, their depredations being manifest, first on the pistils and filaments of the anthers; then on the bases of the petals; and finally, even on the calyx and flower stem, all of these parts gradually blackening and withering, thereby blasting the seed, and wholly or in part destroying the fruit. They affected the strawberry in the same manner, causing what is known among strawberry growers as "buttoning" of the fruit."

[90]Ann. Rep. N. Y. State Agr'l Society, Vol 27, p 889

The species was described in 1856 by Dr. Fitch in his Second Report, it being found, as the name indicates, more especially on wheat[91].

Dr. Lintner[92] includes it in his list of clover insects, and Prof. Osborn accuses it of injuring the styles of apples. In Posey county, Indiana, some years ago, it occurred sufficinetly abundantly to become of annoyance to people, biting the hands and faces of ladies and children.

It seems quite possible to destroy these insects by the use of pyrethrum.

The Scurfy Bark-Louse.

74. *Chionaspis furfurus.* Fitch.

(Ord. Hemiptera: Fam. Coccidæ.)

This is the well-known bark louse of the apple and other fruit trees, Fig. 33 and 34. It is described but not named in Harris' Insects Injurious to Vegetation, p. 254, and other references to it may be found in nearly all our works on orchard insects.

Fig. 33. The Scurfy Bark-Louse. Enlarged.

Specimens of raspberry canes were sent Dr. C. V. Riley from Oxford, Miss., by Mr. R. B. Fulton, who gave the following facts in relation to their occurrence:

"The insect has been ruinous to the black-cap raspberry in this vicinity for the last three or four years. Old raspberry plants have been dug up and thrown away to get rid of the pest. It first appeared (or was noticed) in one garden, and has spread to all in this vicinity. If it is a bark-louse, and if, as stated by Harris, the female has no wings, how could the insect have spread so rapidly to six or eight gardens? I have not noticed it on the red or yellow raspberry. It multiplies so fast that it seems useless to try to kill it by any applications to the plant."

Fig. 34. The Scurfy Bark-Louse, on section of twig.

The Rose Scale.

75. *Diaspis rosæ* Sand.

(Ord. Hemiptera: Fam. Coccidæ.)

This is the common white scale of the rose, which is widely distributed both in Europe and America. Prof. Comstock states that it occurs also on raspberries and blackberries.[93]

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[91] First and Second Reports on Noxious, Beneficial and Other Insects of New York, p. 304.

[92] Rep. N. Y. Agr'l. Soc., 1881–'82, p. 192.

[93] Rep. Comm. Agr., 1880, p. 312.

It is perhaps the same species that was received from Mr. Geo. E. Brackett, Maine, by B. D. Walsh, and to which he refers as the shining mahogany-colored bunches, of an irregularly hemispherical shape and about one-fourth of an inch in diameter, attached in masses to blackberry stems. Some of the eggs had hatched in transit and two minute Chalcidians were found, "remarked for having a yellow scutel."[94]

APHIDES.

(Ord HEMIPTERA Fam APHIDIDÆ)

The following species of Aphides are known to infest blackberry and raspberry.

76. *Pemphigus rubi* Thos.

This was first observed by Prof. G. H. French on the under side of leaves, along the midrib of raspberry, *R. occidentalis*, in southern Illinois and is described by Thomas in Eighth Report of State Entomologist of Illinois, p. 147.

77. *Aphis rubicola* Oest.

Described from specimens found in Minnesota on underside of leaves of *R. strigosus*. Said to be our smallest species of *Aphis*.[95]

78. *Macrosiphum rubicola* Oest.

This is described also from Minnesota, being found also on *R. strigosa*, but on twigs and leaves,[96]

79 *Sepha rubifolii* Thos.

Described as infesting the leaves of blackberry, and resembling *Aphis mali*. Affects the under side of the leaves, usually along the midrib or lateral veins, causing the leaf to curl downwards.[97]

80. *Siphonophora rubi* Kalt.

Dr. Thomas says that he found apterous specimens only of females on blackberry during summer, and that the males are not uncommon on raspberry during November.[98]

THE BLACKBERRY FLEA LOUSE.

81. *Psylla tripunctata* Fitch.

(Ord HEMIPTERA Fam PSYLLIDÆ)

Specimens from Charles Parry, Cinnaminson, N. J., were received by Messrs. Walsh and Riley, and named *P. rubi*, but not described.[99]

In his letter accompanying the specimens the writer says:

"The suckers upon which this insect occurs in the spring commence to twirl around, and, when not interferred with make a complete revolution before they

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[94] Pract. Ent., Vol. 1, p. 102.

[95] Geog. Nat. Hist. Surv. Minn.. Bull 4, p. 60.

[96] Geog. Nat. Hist. Surv. Minn, Rep. 14, p. 27.

[97] Eighth Rep. St. Ent. Ill., p. 121.

[98] Loc. cit., p. 64.

[99] Am. Ent., 2, p. 225.

resume their usual course. The leaves curl up, and become matted around the curl so as to make a safe harbor for the lice-like larvæ, which during the summer, appear on the under surface of the leaves. I presume we can get clear of this insect, after the larvæ are produced, by cutting off the curls and burning them."

In 1880, Dr. Riley made the statement that the species could not be distinguished from *P. tripunctata* Fitch and the species occurred very commonly on pine all over the eastern part of the continent from Florida to Canada.[100] Mr. A. S. Fuller, in same publication, says of its further occurrence in New Jersey:

"It has increased very rapidly during the past half dozen years or more, and unless fruit growers make a more vigorous fight than they yet have done, it will soon get the mastery of most blackberry plantations. The only practical method as yet discovered for checking the ravages of this insect, is, to cut off the ends of the infested canes and burn them. This operation should always be performed either in the morning, or during cool wet weather, else many of the insects will escape, and at all times the severed shoots should be immediately dropped into bags and in them carried to the place where they are to be burned, and there emptied into the fire. If every one having blackberry bushes in their gardens would practice this method of destruction, this pest would soon cease to do much harm."

The 17-Year Cicada.

82 *Cicada septendecim* Linn.

(Ord Hemiptera Fam. Cicadidæ)

Well known as this species is all over the United States, no detailed account is necessary. In common with almost every other woody plant, the canes of raspberry and blackberry are used by the female for a place of deposit for her eggs. In 1885, near LaFayette, Indiana, a field of raspberries and blackberries, lying adjacent to a tract of woodland, was not only very seriously injured by these insects, many plants being killed, but the crop also was seriously curtailed.

As a matter of interest, I will give the years during which the various broods are likely to appear in Ohio: 1895, Champaign county (?): 1896, Central Ohio; 1897, eastern portion of the state, west to Scioto river and Sandusky; 1898, Summit county; 1900, Eastern Ohio; 1902, probably generally over the state.

The Square Spittle Bug.

83. *Aphrophora quadrangularis.*

(Ord Hemiptera Fam Cercopidæ.)

This species is said by Prof. Fernald to occur commonly on weeds, grasses and blackberry twigs. (Bull. 13, 1891, Hatch Experiment Station). From this publication I extract the following relative to these peculiar insects:

"The frothy spittle-like masses—called frog-spittle, toad-spittle, snake-spittle, etc.—are formed by small insects belonging to the family Hemiptera or true bugs, and are seen adhering to the twigs and branches of shrubs and trees, and also to the stems of grasses and other plants.

"During the early stages of its life, by means of special glands, this insect secretes an albuminous liquid and discharges it from the posterior end of the body forcing bubbles of air into it after it has been used in respiration, probably.

[100] Loc. cit., 3, p. 62.

"Two different species of spittle insects are common on grass in Massachusetts, *Philænus spumaris* (Linn.) and *Philænus lineatus* (Linn.), and they also occur in Europe from which country they were probably introduced. Although these two insects feed on many different species of plants, it is said that they are strictly attached to grasses and low plants, and that they never occur on trees and shrubs, except by accident.

"It is not known where they lay their eggs, but as the females are provided with saw-like appendages connected with the ovipositor, it is probable that they cut slits in the stems of the plants, near the ground, in which to deposit their eggs. I incline to the impression that they hibernate during the winter in the perfect state, and lay their eggs in early summer. This is true of the allied *Proconia costalis*, and *Helıochara communis*, which I have often found fully developed in early spring, just emerging from their winter quarters. The eggs are very large as compared with the size of the insect, and as but very few are laid, these pests are never liable to become excessively abundant. This insect remains in the frothy secretion during the early stages (nymph), but after reaching the adult stage, does not make this secretion, and becomes very active. Although the wings are well developed it does not fly any great distance, but makes long leaps, and runs quickly, often with a peculiar sideways motion to the opposite side of the plant from the observer."

"The Lined Spittle-insect, (*Philænus lineatus* Linn.), is about one-fourth of an inch long, of an ochre yellow color, with a whitish stripe on the costa or outer edge of the wing covers, and a brownish stripe within and parallel to it. Some of the varieties are dark brown with a whitish costal stripe.

"Although the mass of froth on the stems of grass is quite large it usually contains but a single insect, which is so small that it can injure the plant but very little, and it is very seldom that the pest is abundant enough to make any material difference in hay crop."

In Louisiana it is generally believed that these insects are the progenitors of the green-headed horse-fly, Tabinus. Some complaints have come from southern Ohio with reference to the abundance of these frothy masses on stems of timothy, but I have not yet learned of any noticeable injury being done.

The Flee-Like Negro-Bug.

84. *Corimelæna pulicaria* Germ.

(Ord HEMIPTERA Fam CORIMELÆNIDÆ)

This bug has a superficial resemblance to a beetle and is often mistaken for one, at first glance. They are small, glossy black in color, except the legs which are brown, and the edges of the wing covers which are white, giving it a margined appearance. The scutellum is so enormously enlarged as to nearly cover the whole back. Fig. 35.

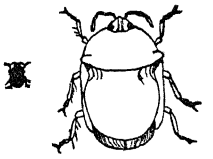

Fig. 35. Flea-like Negro-Bug: natural size and enlarged. After Riley.

The first notice of the destructive habits of this insect were made known by Rev. C. J. S. Bethune, in the Canadian Farmer of Aug. 1, 1867, where it is recorded as injuring the strawberry.

In the Transaction of the State Horticultural Society of Illinois for 1868, Mr. F. A. Holcomb records the occurrence of the insect and its injuries to the raspberry near Quincy, Illinois, in 1866.

The injury is described by Prof. Riley as rendering the berries unsalable by the bed-bug aroma which it communicates to them, as well as by sucking out their juices. Wherever it occurs, the nauseous flavor which it imparts to every berry it touches will soon make its presence manifest, though the little scamp may elude ocular detection.

Besides the strawberry and raspberry, it is known to attack cherry, quince and wheat.

85. *Euschistus variolarius* Pal Beauv.

(Ord. HEMIPITERA Fam PENTATOMIDÆ)

In a paper on the appearance of injurious insects in the vicinity of Constantine, St. Joseph county, Michigan, in 1886, Prof. C. H. Tyler Townsend gives the following observation on this insect:

"A greenish-yellow or grayish plant-bug (*Euschistus variolarius*) was found in some numbers in July, 1886, on red raspberries. Quite a number of the berries were noticed on the bushes, each one having a specimen of this bug upon it, which from appearances seemed to have been engaged in the nefarious practice of piercing the berry and sucking its juices. One of these individuals was a nymph. This species is very common at present, and it would not take much increase to make it abundant, in which case some of our small fruits might sustain a slight amount of injury, though nothing probably that would be appreciable.[101]"

86. *Cosmopepla carnifex* Fab.

(Ord HEMIPITERA Fam PENTATOMIDÆ)

This is one of the true bugs, and belongs with the squash and chinch bugs. Prof. Lintner, State Entomologist of New York, treats the insect in his Second Report, pp. 145-49, as follows:

"The *C. carnifex* has much the general appearance of the Harlequin Cabbage-bug *Murgantia histrionica*, noticed in my preceding report, having the same colors, but being a smaller insect, and proportionately broader in form. Its length is about 0.23 of an inch, and its breadth 0.17 in. The general color is shining black. The head, thorax and coriaceous portion of the wing-cases are granulated. The throax is crossed by a transverse elevated ridge, marked with dull orange and is bisected by a slender mesial line of the same color. Coriaceous portion of wing-covers margined with orange, which is broader basally, thence becoming obsolete; margin of abdomen also, orange. The scutellum is long, pointed, extending over two-thirds of the abdomen, and is marked with two triangular orange spots near the tip, one on each side. The antennæ, legs and proboscis are black.

"THE PUPA.—The pupa, is 0.20 by 0.16 of an inch in length and breadth. It is dull yellow, with the eyes, antennæ and legs (except their basal portion) black The proboscis is black at the tip. The head has two longitudinal mesial, black lines which diverge posteriorly. The thorax has a black line on its hinder margin, centrally, which is sometimes bisected at the middle, and also two rather large black spots, centrally on each side pointing backward and sometimes connected with the black marginal line. A rounded black spot rests centrally on each side of the scutellum, and there is also a black dot near each anterior angle. The wing-pads are edged with black behind, and in addition they bear an S-like character in black extending back centrally from the base. Upon the abdominal segments dorsally are two pairs of shining black points, of which the hinder pair are usually extended laterally into a line, and the front pair are sometimes connected; laterally, are four black dots marking the segments, which are also seen from beneath.

[101] Insect Life, 2, p. 44.

The insect in its larval, pupal and perfect stages, has been sent to me from Souyea, Livingston county, N. Y., about the middle of July, with the statement that they were injuring the potato vines seriously, and they were believed to be poisonous, as the vines shortly after they had been punctured by the insect, withered and died. Paris green had been tried for killing, but to no purpose.

"Subsequently, the mature insect has been sent to me for identification, by Prof. D. P. Penhallow, of McGill University of Montreal, Canada, as an injurious currant insect. It had appeared in large numbers in 1884, attacking the fruit, causing it to fall, and seriously injuring the crop.*

"This species has quite a broad distribution over the United States. Mr. Uhler records it from Maine to Georgia, Texas, Indian Territory, Nebraska, Kansas, Missouri and Washington Territory; also from Port Neuf, Canada, and from Nova Scotia.

"I have found it in large numbers, in former years, at Schoharie, N. Y., in the early part of July, upon some low plants (weeds?)—the species not recorded."

In 1888 I received this insect from New York, and strangely enough from Livingston county also, where it was said to be seriously injuring the potato crop by causing the vines to wither up and die. The next year, from the same locality, came the information that they were injuring the foliage of the blackberry. Prof. Osborn, of Ames, Iowa, tells me that he has observed them in abundance on the foliage of grape, but did not notice that they were especially injurious.

The Tarnished Plant Bug.

87. *Lygus pratensis* Linn.

Ord. Hemiptera: Fam. Capsidæ.

This is a species which is very abundant, especially over the country east of the Mississippi river and is everywhere an unwelcome guest. The following relating to the early history of the species is extracted from the 13th Report of the State Entomologist of Illinois, where an exhaustive article on the pest and its ravages may be found:

"This species was first described by Linnaeus and later by Palisot de Beauvois under the name of *Coreus lineolaris*, in a work on insects collected in Africa and America, published in parts, between the years 1805 and 1821. It was next described by Say as *Capsus oblineatus*, in 1831, in a paper entitled, "Descriptions of New Species of Heteropterous Hemiptera of North America." Say notes the similarity of his species to that described by Beauvois, but nevertheless considers them distinct. He records its occurrence at various points, from Pennsylvania to Indiana and Missouri.

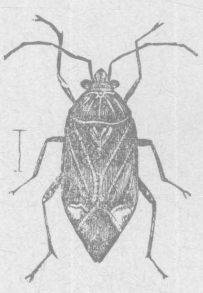

Fig. 36. Tarnished Plant Bug. Adult.

The first important mention of it as an injurious insect, we owe to Dr. Harris, who, in his "Treatise on Insects Injurious to Vegetation," (1841,) describes it as *Phytocoris lineolaris*, notes its injury to various blooming plants and to the potato, gives a very good account of its habits, and makes some recommendations for its destruction, based, however, upon conjecture, and not upon experiment.

"He knew nothing of its life history beyond the fact that it occurred in April and also in October, and probably hibernated as an adult. He believed its abundance at certain seasons to be due to dry weather, and accounted for the effects of its puncture by supposing it to poison the plants attacked.

*It reappeared in still larger numbers the following summer.

"In the Prairie Farmer for 1860, (p. 308,) and for May 2, 1863, this species is charged by Mr. B. D. Walsh with injuries to the apple, quince and pear. The second of these articles was illustrated.

"In the second report of Prof. Riley, as State Entomologist of Missouri, (1870) occurs the next important article upon this species. Besides rehearsing the facts already published by Harris, he reports it as seriously injurious to various fruit trees, and to cabbages, turnips, and other garden vegetables; mentions the place of oviposition, and gives an (inaccurate) descriptive note on the young. He assumes, with hesitation, that two generations occur during the year. He also recommends some additional topical applications, but not upon experimental grounds.

"In the 'American Entomologist and Botanist' for September, 1870, Prof. Riley reprints this article from his entomological report, adds some important items respecting injuries to vegetation, and details the results of some experiments made by a correspondent, for the destruction of the pest in orchards.

"In 1872, a valuable article was published by D. B. Wier, in the Prairie Farmer for January 27 of that year. Mr. Wier's experience with this plant bug in his nursery was especially interesting, and he gives a very full description of its injuries to fruit trees, together with some additional items relating to its life history.

"A brief account of the species appeared in 1879, in the entomological report made to the State Horticultural Society of Iowa, by Prof. Herbert Osborn, of the Iowa Agricultural College. This, however, adds little to our previous knowledge of the insect, except to report its occurrence in destructive numbers in the orchards of Central Iowa.

"It is not mentioned in the numerous and voluminous reports of Dr. Fitch as State Entomologist of New York, nor in that of Prof. Lintner, his successor. Dr. Fitch gives, however, a detailed account of another species of the genus which occurs throughout the United States, and seems to have become especially destructive in New York, during the year 1869. This is the *Lygus lineatus*, of Fabricus; a species whose life history, habits, and injuries to vegetation, are extremely similar to those of the insect under consideration. This was common enough in Illinois to attract the attention of Dr. Le Baron in 1870, and was briefly treated by him in his first report, under the name of the 'Four-striped plant bug, *Capsus* (*Phytocoris*) *quadrivittatus*, Say.'

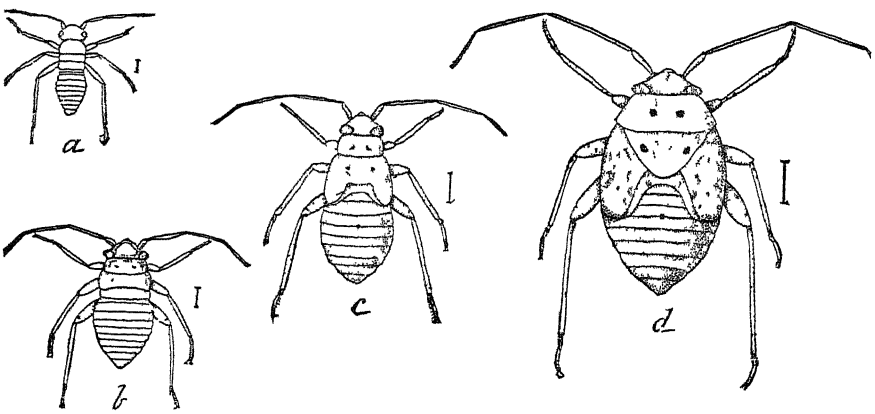

Fig. 37. Tarnished Plant Bug. *a*, first stage; *b*, second stage; *c*, third stage; *d*, fourth stage. After Forbes.

"The life history of this species cannot yet be given in all its details, but the essential facts are well enough known. The adults, (Fig. 36) with a very few pupae

intermingled, pass the winter under rubbish and matted vegetation, in a variety of situations, no preference being shown for one kind over another. They are consequently found in the woods among the dead leaves, under boards, in grass, under the broad leaves of mullein, and in general wherever a suitable shelter against the winter weather offers.

"With the earliest warm days of spring they venture forth, and collect upon whatever tender springing vegetation of tree or shrub offers them a supply of sap within the reach of their rather slender beaks. On their food plants they lay their eggs; although the precise time when they commence this operation has not yet been made out, nor indeed, has the egg itself ever been seen. The young (Fig. 37) soon appear, however, mingled with the adults as early as the latter part of April and the first of May, (in Southern Illinois,) and feed with them side by side. By the middle of May, the older individuals have matured, and then all stages may be found together upon the same plants; but the winged forms scatter widely, and in June and July are generally distributed wherever suitable food occurs. Young of all stages and adults of both sexes have been found by us, during this last summer, in every month from May to September, inclusive,—a fact which makes it difficult to say how many broods appear. It is certain that there are two, but whether more than that, it will probably be impossible to tell with certainty without rearing specimens in confinement. By the middle of October, the young have all about transformed, and from that time forward few but adults are to be seen. These frequent goldenrod, cabbage, turnip, and other autumnal plants, and betake themselves in due season to their winter quarters, as already related.

"The best account extant of its work in the orchard and nursery is that given by Mr. Wier, in the "Prairie Farmer" article already cited. He writes from a full heart, having, in one year, suffered a loss from this insect of about a thousand dollars worth of young trees. He says: 'What the chinch-bug is to the spring wheat grower, this bug is to the nurseryman and fruit grower, in regions adapted to its multiplication; and, like the chinch-bug, there seems to be no means of combating it with much chance of success. I have lost within the last three years, by its ravages in our nursery and orchard, enough to pay the salary of our State Entomologist; I have closely studied it during that time, and to-day I feel that I shall have to stand by next spring utterly impotent to combat it successfully, and see it blast my winter's work of grafting, in a great measure, and destroy every germ of plum and pear on my grounds, making my rows of young pear and plum trees look as if they had been singed with fire during four long weeks.

"As soon in the spring as the first buds on our pear, mountain ash and quince begin to burst, and the days are bright and warm, these bugs commence to feed on them, and every bud that they pierce with their poisonous beaks is utterly destroyed. As the terminal bud is the first to push, it goes first, and then each successive bud down the branch; so if the tree is small and there are bugs enough, every free bud on the tree is killed, and it has to push its dormant buds. These are destroyed in the same way, and the tree stands for a long time after this rough treatment, apparently considering whether life is worth the immense effort of arranging cells for new points of growth, to be destroyed in their incipiency. It goes to work, and doubtingly, timidly and weakly sends out its best, though spindling, effort. If the Capsus captures this last effort, and the tree is weak in its store of food, it throws up the sponge; if not, it makes a weak, unsightly growth, for the reason that the new shoots do not start from proper axis.

"The buds of root grafts cannot stand many stoppings; so where these bugs are plenty, the rows show this, indeed. After feeding and destroying in this way for about a month, the female lays her eggs and dies. It is asserted as a fact that the beaks of the bugs are poisonous to the plants on which they feed. I have not found this to be so. I have been unable to discover any other injury than the same

mechanical injury that would result from any puncture, if attended with the same depletion of sap.

'This bug is very quick in its motions. You may approach a plant on which dozens of them are feeding; as soon as they discover your approach, they all dodge around quickly to the opposite side of the plant, out of your sight, if you disturb them, they either fly away, (they are brisk flyers, and are called flies by many), or drop to the ground. Early in the spring, they are dormant on cool mornings, and are easily picked off or shaken down and destroyed.'

"Prof. Riley remarks in his Second Entomological Report: 'Quite early last spring, while entomologizing in southern Illinois, I spent a day with Mr A J. Ayres, of Villa Ridge, and was surprised to learn that he had become quite discouraged in his efforts to grow young pear trees, on account of the injuries of a certain bug which upon examination I found to be the 'Tarnished Plant-bug.' In the article in the 'Entomologist and Botanist' to which I have referred on a previous page, he further says: 'This insect has been very injurious the present year. Mr. J. P Jones, of Keytesville, Chariton county, Mo., complained bitterly to us this spring of its injuries to pear and apple trees in his section; Mr. D. B Wier, of Lacon, Ill., considers that it has damaged his crops to the amount of $1,000; and the ad interim committee which lately visited his orchards, report but little fruit on the pear trees on account of its having poisoned and killed the blossom buds. No doubt the extreme dry weather has had much to do with the increase of these pests.

"The apple pear, cherry, plum and quince, are among the fruit trees reported as especially subject to its attacks, and Prof. Riley has also noted it as an enemy of the grape, which it injures much as its does the twigs of trees"

The young fruit of the strawberry, young celery, and almost every shrub, plant or vegetable seems to fall a prey to these pests. They cluster on the tender shoots or young fruit, and as they suck the juices therefrom they appear to leave a poisonous effect, as the plant, or whatever the object attacked happens to be, soon turns black and dies.

The adult insect and its various stages of development are illustrated by the accompanying figures. They pass the winter in matted grass and like places, the leaves of mullein being a favorite place of refuge. So far, kerosene emulsion is the only measure which promises to be an efficient remedy.

88. *Iulus impressus* Say. (Fig. 38.)

A number of years ago a lady in Indiana purchased from her grocer a quantity of black raspberries for preserving. The case consisted of 16 quart-boxes, such as are usually employed for holding fruit. On looking the berries over, preparatory to cooking, she began to find these worms intermingled among and devouring the fruit. By the time a small portion of the supply had been inspected, upwards of fifty worms had been found, and the fruit was disposed of in a way rather more summary than that of preserving. Samples of both fruit and worms, submitted to me, left no doubt as to either the species of Iulus engaged, or its appetite for this kind of fruit. Whether the worms infested the fruit in the field, or whether the case was left on the ground and they made their way

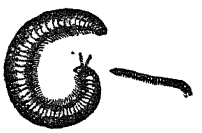

Fig. 38.
Iulus impressus

into the boxes, I was not able to learn, but the latter appears more probable.

SUMMARY AS TO INJURY.

Division I.

4, 12, 48, 53, 54, 72, 87.

Division II.

5, 31, 33, 36, 37, 38, 47, 50, 56, 69, 71, 73, 74, 81, 82 84, 86.

Division III.

1, 2, 3, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24 25, 26, 27, 28, 29, 30, 33, 34, 35, 39, 40, 41, 42, 43, 44, 45, 46, 49, 49ª, 51, 52, 55, 55ª, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 70, 75, 76, 77, 78, 79, 80, 83, 85.

SUMMARY AS TO REMEDIES.

I. Arsenites.

13, 14, 21, 23, 24, 25, 26, 27, 30, 32, 37, 40, 46, 59, 60, 61, 62, 63, 64, 65, 66, 67.

II Hellebore.

3, 4, 19, 29, 33, 36, 40, 42, 43, 44.

III. Pyrethrum.

3, 11, 17, 19, 21, 29.

IV. Kerosene Emulsion.

19, 21, 27, 54, 58, 66, 67, 69, 74, 75, 76, 77, 78, 79, 80, 81, 85, 87.

V. Pruning.

5, 6, 8, 10, 12, 28, 41, 47, 48, 49, 53, 57, 71, 72, 82.

VI. Hand Picking or Collecting.

15, 20, 34, 45, 50, 51, 52, 54, 58, 66, 67, 68, 69, 70, 82, 84, 85.

VII. Collecting the Infested Leaves.

1, 2, 7, 16, 35, 36, 38, 39, 40.

VIII. Destroying Infested Fruit.

9, 31, 50, 51.

IX. Digging Out.

55, 56.